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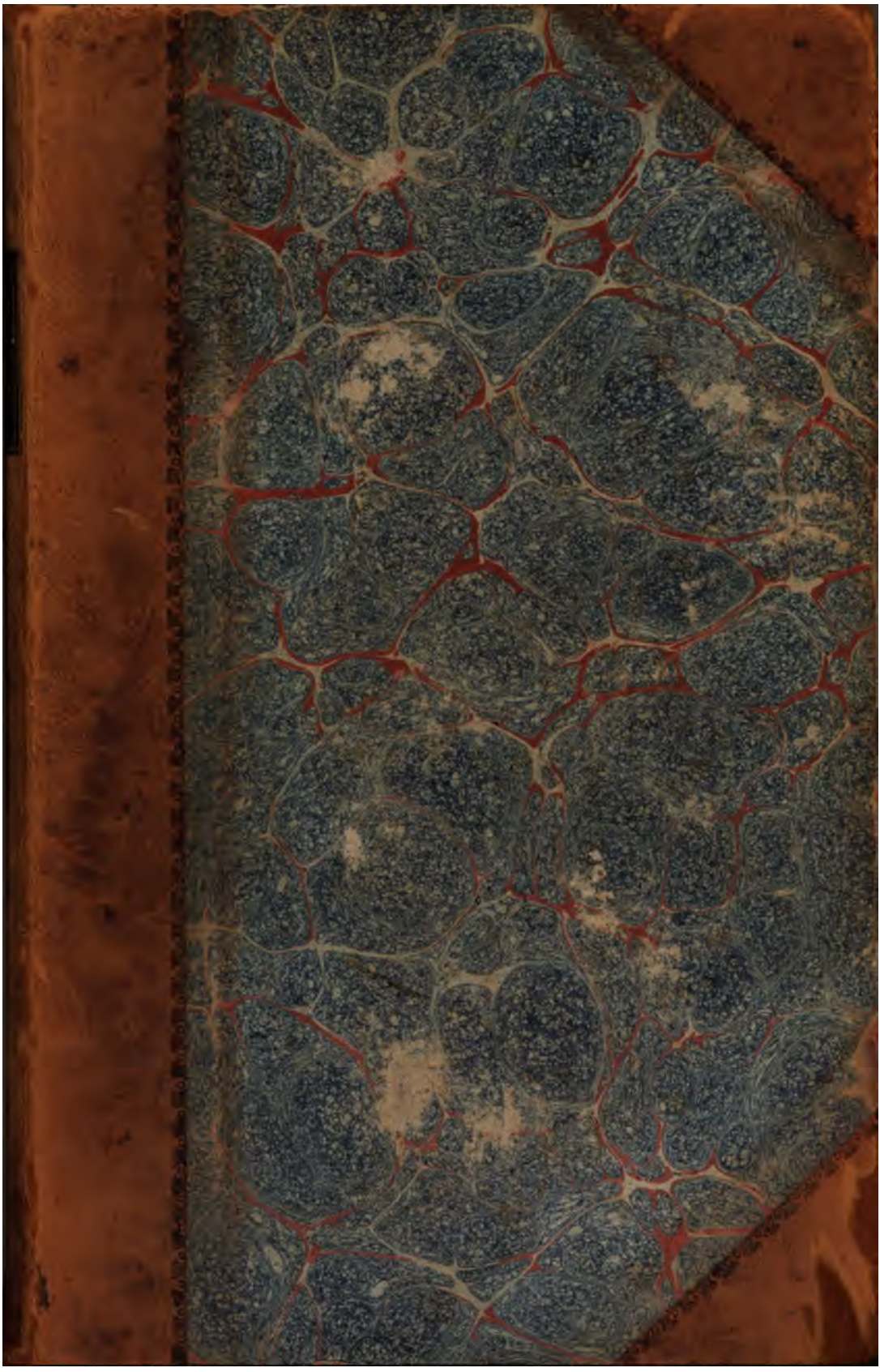

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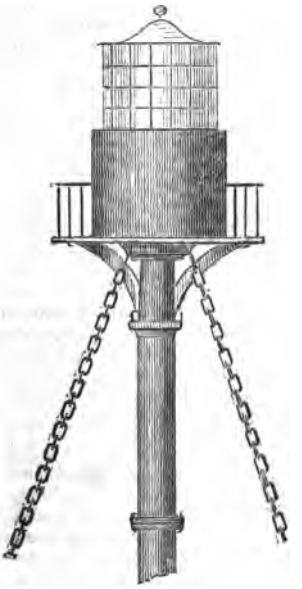
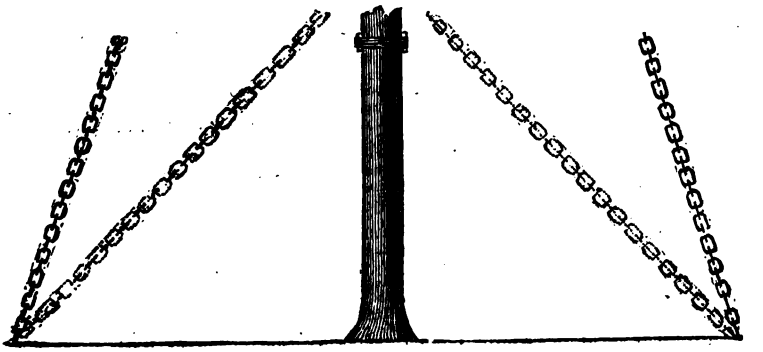
LAKE'S IRON LIGHTHOUSE.





LAKE'S IRON LIGHTHOUSE.

Sir,—Vitally important as the erection of lighthouses must be considered, both in a commercial and in a philanthropic point of view, I think it must be confessed that they are still far from being so numerous as they ought to be. The subject which called into action and fully developed the splendid abilities of the immortal Smeaton—and we cannot read the description of his Eddystone lighthouse without paying him fresh idolatry—has been till now attended with that very serious drawback—enormous expense. Whether lighthouses had their origin in a spirit of true philanthropy, or in a spirit of commercial enterprise, we have yet to lament that thousands of pounds worth of property, nay, even scores of our fellow-men, are annually lost on their own shores, in consequence of the absence of a warning light! And till some means are devised of reducing the expense attendant on their adoption, this ruin and devastation must go on unchecked. Such being the melancholy truth, I now hand you a rough sketch of a lighthouse; the idea of which has been afloat in my brain for a considerable time, and perhaps you will consider it worthy of a place in your valuable Journal. If so, your scientific readers will soon be able to judge whether it possesses merit enough to justify its adoption; and I should be glad to see their opinions of it recorded in the *Mechanics' Magazine*. I think the idea is quite new.

The column is supposed to be of bronze or cast-iron, and two or three feet in diameter *only;* upon this is fixed the keeper's house, and upon that the lantern. The column, you will perceive, is intended to be kept steady and in place by the chains; these constitute its chief novelty. One end of the chains, which may be six or eight in number, as may be considered most judicious, is fixed immovably in the solid rock, and the other end fastened to the top of the column. Should one circle of chains be thought insufficient, another may be fixed half way up the column, as shown by the dotted lines. The inclination of the chains should be as great as natural obstacles would allow, and varying with the height of the column.

You will perceive there is only one room; but it might be made of rather large dimensions, to serve at once as a living and a sleeping-room. The column might be hollow to thirty feet of its depth, for containing oil; and water might be kept between the two concentric circles of metal, forming the living room. Provisions might be kept in two water-tight "safes," and suspended from the gallery over a wheel; and coals might be placed at the foot of the column, enclosed in a strong cast-iron or metal coffer, and drawn from thence by a windlass, as occasion required. The keepers would mount at once to their aerial abode by a chain ladder.

I will not enumerate other details, as they will at once suggest themselves to the reader; and I hope, that without being too prolix, I may not be too concise.

I am inclined to think, that this description of lighthouse possesses many great and important advantages; the chief of which I will just name; and first, between this and one of stone, there can be no comparison as to *expense*. The *time* of erection may be contracted from years to months, like Mr. Brown's. As to the wave and the spray, they may be left entirely out of the question; and the *strain* from the winds, and the impinge of waves, comparatively speaking, is reduced almost to a nonentity. The only question then is, as to *strength;* and who will deny that its strength is ten times greater than that of a stone one? For as long as the fastenings and the chains remain whole, and the foundation of the column good, it may defy the raging power of the most tempestuous sea. Its strength is deduced from the principle of the triangle, and while the two ends of the hypothenuse and the base of the perpendicular remain secure, it is impossible for it to overset; and the strength of the one is the size of the chains, and that of the other the solid rock.

I am, Sir, truly yours,
JOHN LAKE.

Gayton, Northampton, Aug. 31, 1836.

MEDALLIC ENGRAVING.

(From the *Athenæum.*)

The idea of employing machinery for the purpose of engraving upon metals is not of very recent origin: as was the case with steam navigation, the principle was recognised many years before it was put into successful practice. In the year 1830, Mons. A. Collas, an able mechanician at Paris, having been commissioned by an engraver at Ghent to make a ruling machine for him, constructed one for himself, upon a somewhat different principle, with which he made several attempts to execute engravings upon copper,

in the style of a pattern which had been published in the *Manuel des Tourneurs* upwards of twenty-four years before. It was not till six months' labour and thought had been bestowed upon it that M. Collas brought his invention to a certain degree of perfection: he produced his first engravings in the spring of 1831. Of the attempts at a similar instrument, made in the United States, we are informed, and believe, that he had seen or heard nothing; but in the year 1833 he chanced to meet at Paris with an old mathematician from Geneva, whose father had, some sixty years before, been employed in executing engravings by machinery upon the cases of gold and silver watches; so that the remotest traces of this art may be dated about the years 1775 to 1780.

It has been ascertained, beyond all doubt, that this invention is not of domestic growth in England. It was in the year 1817 that a die-sinker of the name of Christian Gobrecht, then living at Philadelphia, produced by a machine an engraving upon copper of a medallic head of the Emperor Alexander of Russia, several impressions of which were distributed in that city. Mr. Asa Spencer (now of the firm Draper, Underwood, and Co.) took one of Gobrecht's machines with him to London in the year 1819, which was its first introduction into London. This machine was principally designed for ruling straight and waved lines; it was employed in London; and its uses exhibited and explained by Mr. Spencer to several artists. It attracted the particular notice of the late Mr. Turrell, an engineer, and he obtained permission to make a drawing of the machine, for the purpose of having one constructed for his own use. Ten years afterwards, in the year 1829, Mr. Joseph Saxton, an American, born at Huntingdon, in Pennsylvania, who had known Gobrecht, and seen the engraving from the Russian medal, contrived a machine somewhat similar in principle to the one brought to England by Mr. Spencer; in this he first introduced a *diagonal tracer*, for the purpose of correcting some of the defects which existed in the medallic engravings executed by Gobrecht's and Spencer's machines; these had all of them an unpleasant twist upwards, and an evident distortion of the features of the head. In the following year, an idea being started of applying this new method to the engraving of designs for bank notes, Mr. Spencer again bestowed considerable pains upon the improvement of his invention, without any success. Mr. Turrell, who was acquainted both with Spencer and with Saxton, communicated his drawing and his ideas upon the subject to Mr. Bawtry, who then held the situation of engraver to the Bank of England, and it was this gentleman who originally applied to Mr. Lacy to construct a machine of this description for him. Mr. Lacy was then, as Mr. Spencer had been, connected with the establishment of Messrs. Perkins, Bacon, and Petch, bank-note engravers in Fleet-street, and was the person employed, in the year 1832, to execute the engraving from a medal representing the bust of our present King, which appeared in the frontispiece of the "Keepsake" for 1833. The contracting parties did not come to a satisfactory agreement, and the negotiation was broken off. It was probably at that time that Mr. Bawtry entered into communication with Mr. John Bate, of the Poultry, optician and maker of mathematical instruments to the Board of Admiralty. Mr. Saxton had been introduced to Mr. Bate shortly after his arrival in England, and had, we believe, given to the latter his first notion of such a machine by exhibiting to him an engraving upon glass, executed by it. During the succeeding interval, Mr. Saxton had continued to attempt the improvement of his diagonal tracer, which, though some distortions were manifestly obviated by it, was still utterly unable to give the effect of light and shade when employed to engrave medals of very bold, or, rather, *steep* relief, and inevitably left blank spots in the engravings. Here the matter rested for awhile.

In the earlier part of the year 1832, the Messrs. Bate having been informed that Mr. Saxton had effected several improvements in his machine, had an interview with him, for the purpose of exchanging their ideas upon the subject. But a natural feeling of jealousy prevented either party from exhibiting to the other his machine; the Messrs. Bate stated, indeed, that they had succeeded in removing the distortions which existed in their earlier productions;—Mr. Saxton, on the other hand, referred to his own invention, and declared himself capable of executing by his machine as much as they could do by theirs; finally agreeing to satisfy them of the truth of his assertions, by putting into their hands an engraving, in which all distortions should be avoided. This engraving was a head of Franklin, with a bust of Minerva copied from a gem or cameo. Upon examining it the Messrs. Bate, however, seemed to think that some distortions, though slight ones, still remained. It was then proposed that both parties should execute an engraving from a gem representing the head of Ariadne, an impression of which, in wax, Mr. Bate, junior, undertook to send to Mr. Saxton. But here the matter ended—the wax impression was never sent, and two months afterwards Mr. Saxton was informed that Mr. Bate had taken out a patent for an improved machine, particularly specifying the introduction of the diagonal tracer, which happened to be the same as his own. Mr. Saxton, disgusted with the turn which matters had taken, turned his attention to other

mechanical inventions, and subsequently sold his machine to Mr. W. Trevylian, in whose hands it now remains. From that period nothing was done in the way of engraving from medals, and no step taken, either by Mr. Bate himself, or his friends, to bring his invention before the public; the invention, as it were, remained dormant in England.

It was towards the close of the year 1832 that M. Collas sold his patent to a few gentlemen, who, with the aid, and under the direction of some of the first French painters, sculptors, and engravers, united themselves in a company, under the firm of Lachevardiere and Co. It is to the enterprising spirit of these gentlemen that we are indebted for the "Tresor Numismatique et de Glyptique" (see *Athenæum*, No. 388, p. 261), which has now reached the extent of 600 plates of medals, bas reliefs, &c. representing upwards of 5000 subjects. This work has been widely circulated in France and throughout the continent: most of its plates, for beauty of effect and artist-like execution, leave the eye nothing to desire. It is needless to remind our readers, that the French company, just mentioned, has for some months been actively bestirring itself, for the purpose of applying the invention of M. Collas to the illustration of our medallic history; and that a petition for the assistance and patronage of Government to such a national work was laid before a Committee of the House of Commons during the recent session. These efforts have been met by a determined opposition on the part of certain of our native artists, who have attempted to quench the scheme, by bringing forward Mr. Bate's almost forgotten invention, in proof that the ground was pre-occupied, and by denouncing the French engravings as false, distorted, and mathematically inaccurate. In answer to the first plea, it is enough to state the fact, that nothing was done by Mr. Bate in the way of making his invention popular—no plan thought of, of applying it to a grand national undertaking—till the French company, with a superb work to point to as a specimen of *what their machine had effected*, laid their proposals and petition before Parliament. The second argument, a charge of mechanical inaccuracy brought against the French engravings, will be disposed of with equal ease, though not quite so briefly.

It will be admitted, without hesitation, that the best representation of any subject, as a work of art, is the one which shall convey the most faithful and pleasing impression of its general effect; that, as the said representation is to be judged of by a pair of eyes, and not by a pair of compasses, there are cases wherein the latter may *prove* a mathematical incorrectness, which the former will not acknowledge, and which, therefore, in no respect, impairs the merit of the copy. In examining a medal, *if it be laid flat upon a table*, all the effects of light and shade will disappear, and its bold outlines only strike the eye; whereas, *if it be taken up in the hand*, the relief becomes apparent, and the design is set off with the powerful aid of *chiaro-scuro*. The professed medallist may possibly prefer the first mode, as the best means of obtaining the exact proportions of the work before him; the general amateur and artist will assuredly give preference to the medal as seen in relief, being the more characteristic and pleasing aspect. It is to the faithful rendering of the latter effect, that the attention of the French engravers has principally been directed, at the necessary expense, in some cases, of geometrical exactness. A complaint, therefore, has been raised against their works, as unfaithful—they have been proved guilty of incorrectness, by the compasses, and the harsh word "distortion" has been liberally applied to them. But we are persuaded, that the weight of the objection is merely in the harshness of the word: the result of a careful examination of many specimens laid before us, has convinced us that there is no defect in the works executed by the French machine; there may, indeed, be occasional deficiency, inasmuch as, while the machine cannot give any thing but what is on the medal, it may not, in every instance, give *all* that is there. Granting, then, that the general effect of the medal, when held in the hand (that is, when seen in *chiaro-scuro*), be faithfully and artistically rendered by the French machine, it is fruitless to *reason* about an imperfection, of which the compasses, and not the eye, are sensible. It should further be insisted upon, that this "incorrectness" with which the works of the French machine have been charged, is not necessary to it, but has been merely sanctioned for the sake of effect by the presiding artists, on the principles just laid down. Besides other engravings of geometrical exactness already produced, a plate is in preparation containing the Soane medal, the head of Henry the Fourth, the Ariadne, and other subjects, by which the proprietors are prepared to prove that the style of execution which they have adopted has been a matter of choice, and not enforced upon him by any defect in the machine.

The universal approbation given to the engravings of the "Trésor" by the artists and amateurs of the continent, who do not undervalue scrupulosity of outline and precision of drawing, may be quoted in support of the line of argument we have adopted: we may also, in confirmation, select a few passages from the evidence given before the Committee of the House of Commons upon the subject. Sir Francis Chantrey, when asked whether the mathematical inaccuracy

objected to, " produced an idea of distortion or any disagreeable effect to the eye," answered, that " it never produced any disagreeable effect to his eye, nor was he aware of it till it was pointed out to him;" and, therefore, he considered it of no very essential importance, and expressed his unqualified satisfaction in the engravings produced by the French machine. Mr. Hawkins, of the British Museum, when asked a similar question, gave a similar answer; he said that "a deviation, which is not visible to the eye, is not to be considered as a distortion;" and pronounced M. Collas's method as " giving the best idea of the medal of any method he had seen." Mr. Pistrucci, of the Mint, when examined before the Committee as to the merits of the French and English machines, gave it as his opinion, " that both are very clever, but each of them is deficient in that which makes the chief merit of the other: the French machine is beautiful and admirable for effect, and gives a correct idea of the work; but in a perspective view, or what I may call more appropriately foreshortening, it does not give the objects precisely as we see them, when we look at the centre of a real medal, but in chiaro-scuro, and with much effect. The English one gives it straight as far as I can judge: but I cannot say that it is mathematically correct with the original, not having had the original medal before me to compare it with; and it is possible that there may be a difference in the height, though not in the breadth of the objects rendered; but the engraving is flat and hard, with little or no effect."

We think that the above will suffice to convince our readers that the objections raised against the engravings produced by M. Collas's machine, are frivolous and futile. It is needless for us to repeat once again our opinions with respect to the feasibility and interest of the national work proposed; and if those who have any doubts on the subject, will examine the magnificent engravings of the portrait of Louis Philippe, and the one from the bas-relief of the Canterbury Pilgrimage, we think they will be, like ourselves, fully satisfied that such a work could not be in better hands than those of M. Collas and his enterprising coadjutors. We have now only to describe the specimens:—

No. 1. Innocence prostrating herself before Justice, and entreating her protection; Violence is represented by a warrior holding a naked sword.—Sauvage.

2. Part of the Phygalian Frieze.

3. Cupid and Psyche; from a cameo by Louis Pikler, after a bas-relief by Thorwaldsen.

4. Vulcan forging the shafts of Cupid; from a cameo by Pikler, after a picture by Raffael Mengs.

5. Antigone and Ismena before the Temple of the Furies, urging Œdipus to return to Thebes; from a cameo in onyx by Louis Pikler.

6. The Heads of Augustus and Livia; from an ancient cameo in sardonyx.

7. Hercules stifling the Nemæan Lion; from a sculpture in bronze of the 15th century.*

ACCOUNT OF AN AURORA BOREALIS, WITH A NOTICE OF A SOLAR PHENOMENON. BY CAPT. R. H. BONNYCASTLE, R. E., TORONTO, UPPER CANADA.

(From the *American Journal of Science and Arts.*)

I. *Aurora Borealis.*

Having witnessed from the days of my boyhood, the splendid phenomena of the Boreal Aurora, in almost all the latitudes under which it is usually seen, as far north as to have observed the sun at midnight, and particularly during a long sojourn in Shetland, where the people imagine, from its extremely swift changes and inexpressible vividness, that they can actually hear its rushings, I have ever been anxious to seize all opportunities of endeavouring to catch its Protean forms, and to describe them, in hopes that by exciting attention to facts concerning this wonder of northern skies, science might be more attentive to its appearances, and that at length it might become a portion of the duty of meteorologists to detail in their columns, all circumstances concerning it which they might observe.

The Aurora in the high northern latitudes, when at its extreme, is almost dazzling, and the quickness of its motions approaches that of lightning. In other situations, it has also been observed to assume irised colours. But although all these combined are eminently wonderful, and strike the spectator with profound admiration and awe, yet perhaps the regions of Upper Canada, bordering on Lake Ontario,† exhibit, though not so

* With every respect for our esteemed contemporary, we must say, that if the capabilities of M. Collas's machine are to be judged of from the specimens here referred to, its superiority is extremely questionable. The utmost that, in our humble opinion, can be fairly said of them as works of art is, that they are striking and curious—considering how they have been produced—not that they are in themselves remarkable either for truth of delineation or excellence of finish. We have seen much better specimens of the art, both English and American.—Ed. M. M.

† Not having observed it elsewhere in Canada, I speak only of locality as a personal observer.

splendid and varied a display of this mystery, yet one equally, or perhaps more, interesting to the philosopher. I have now witnessed the Aurora at Kingston for upwards of four years, and in a former volume of the *Transactions* have described a magnificent scene which occurred there two years ago.

During the winter months, on Lake Ontario, the Aurora may be said to be the almost constant companion of the dark and cheerless nights, and it occasionally presents itself at all other times of the year; nor is it in winter a mere display of a glorious phenomenon, the utility of which has not yet been exemplified by science, for it sheds a continued and pleasing light, which resembles that of the crepuscular. The light does not, as in Europe, emanate from the vivid streamers which dance over the starry floor of the heavens, in ever-changing and inexplicable mazes, but proceeds from the northern horizon, over which a pale, luminous, low, and depressed arch, embracing an extent of from sixty to ninety degrees, is commonly thrown. This arch is generally luminous in its whole body, not on the rim or verge only, which fades away into ethereal space, but from its superior circumference to the chord formed by the horizon itself, and varies in its elevation, from ten to fifteen and twenty degrees. Wherever it embraces stars, these luminaries are either veiled or dimly seen, being strongly contrasted on a fine star-light night with their fellow orbs of the southern heavens, which appear to shine out with double brilliancy.

Within the space comprehended by this arch of light, continual changes are operating, if the Aurora assumes a splendid shape. Dark volumes of vapour, not like clouds, but blackening in a moment, rise and fall, whenever a ray or an interior arc begins to form, and it is remarkable, that this darkness usually accompanies the commencement of every change in the scene, thereby increasing the majesty and beauty, as well as the brilliancy, of the spectacle.

But it is impossible for any pen adequately to describe a phenomenon, which is continually presented in these regions; and it is with diffidence that I continue a task imposed on myself. It will, therefore, be more satisfactory to detail the circumstances attending a very recent repetition of one of the most beautiful of those which have been seen at Kingston this winter, nearly the whole of which I saw, and whatever escaped me was related by a very accurate observer.

On the evening of the 11th of December, 1835, the sky, after the sun had sunk, was dark and gloomy, and although there were but few clouds visible, and the stars were rapidly brightening, a change of weather was apparent. Snow had fallen, for the first time, on Wednesday, the 9th, after a short space of great cold, to the depth of about five inches, and the thermometer had sunk afterwards to 16°, at which it stood on Monday, the 13th. On Tuesday it rose to 30°, and rain in abundance falling, removed the snow entirely. It was exactly midway between the extreme cold and the thaw, that the Aurora took place, the thermometer at the time standing at about 26°, and the wind, a gentle breeze from the north-west. The barometer stood at 29·9, at 9 p. m., at an elevation of 40 feet above the lake, which is 219 feet above the level of the sea.*

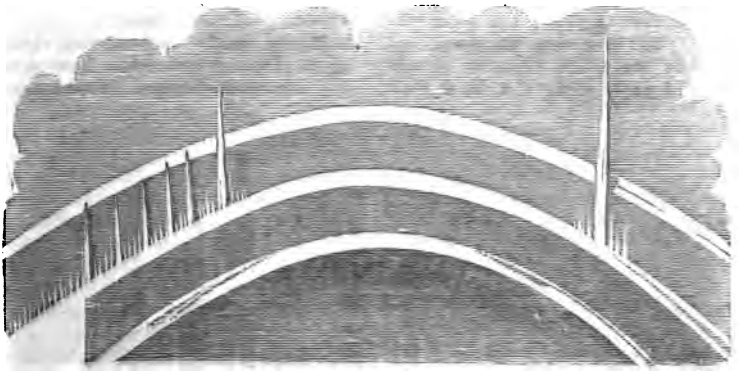
Its first appearance, after darkness had completely set in, was by the luminous arch above-mentioned assuming its wonted place. From this arch, in the north, arose almost incessant streamers of bright white light, which shot upwards to the zenith, and streaked the dark sky with their silvery lines.

Once a mass of light suddenly opened in the zenith, and from it darted out innumerable pencils of bright rays, overspreading the dark vault of heaven with their glories, and seeming for a moment to illuminate the sky with a star, which its vast space was scarcely capable of containing.

Again, rods of white light would dart forth from the northern horizon, and one single one, in particular, spanned the whole arch of heaven, touching the southern horizon over the great lake.

This play of the Aurora continued from seven till near nine, and was most brilliant and magnificent about nine, when it assumed another and not less singular attitude, of which the following is a faint attempt to delineate:—

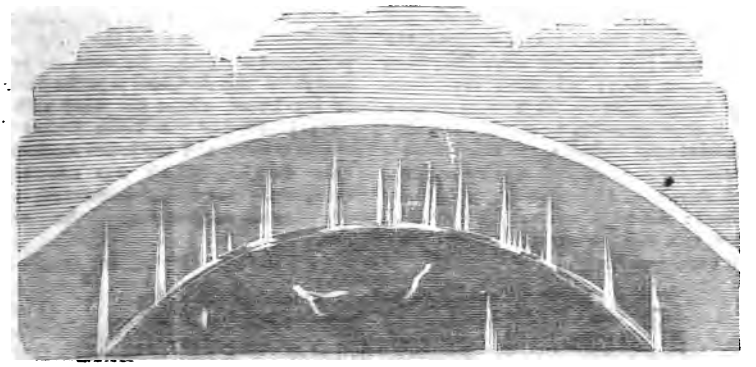
* The barometrical observations were made at the Hospital on Point Henry, by a very accurate observer. On the 10th of December, it indicated, at 9 a. m. 29·5, at 9 p. m. 29·7; on the 11th, at 9 a. m. 29·8, at 9 p. m. 29·9; on the 12th, at 9 a. m. 30·1, at 9 p. m. 30·1.



These arches are not so flat as they should be, but the space is insufficient to show them exactly. The lower one was usually the boundary of a very dark black, changing mass; between the lower arch and the second, the space was not so dark; and between the second and third, or upper arch, it was still lighter, excepting where the coruscations shot upwards out of the second arch, and there it was very dark. The second arch was incomplete.

The ray shooting up on the right was brilliant in the extreme. Stars were partially visible above the third arch, but the bright ones in Ursa Major, on the left, had lost all their splendour, and the constellation could just be traced. The obscuration of the heavenly bodies reached almost to the zenith, above the centre of the arch, and was less over the extremities.

The first appearance lasted long enough for me to go into another part of the house and make a hasty sketch; on my return to the window, it was altering to the following form:—

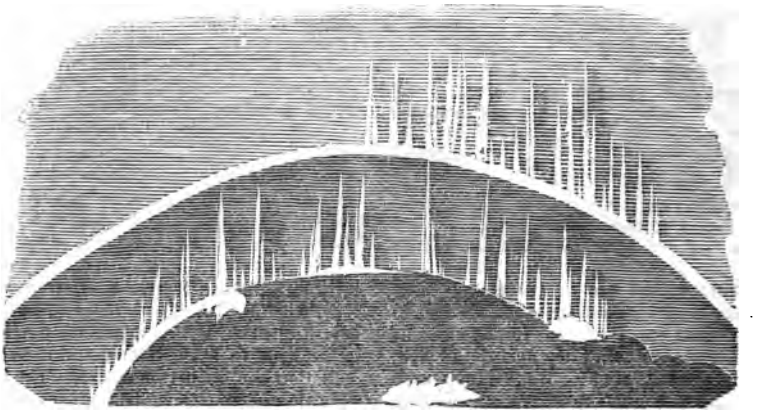


The lower arch had somewhat heightened and become darker, with here and there spots of light in it, whilst from its circumference shot out brilliant rays and pencils of light. The second arch had altogether disappeared, but the upper one held its wonted place. It must be observed, that the upper arch was always paler, and more indistinct in its outline than the others. Faint stars now appeared through the darkish vapour, between the two bands or arches of light, and the lower band was indistinct, excepting to the left of its central space, where it was vividly depicted and extremely well defined by a sharp band of bright light, cut off, both above and below, by very black vapoury masses. This second appearance lasted, also, long enough to enable me to make a hasty sketch of it.

None of the pencils or rays which shot out of either of the changes of the Aurora, were so quick, or so intensely vivid in

their action or light, as those seen in the more northern regions, nor were they coloured; but they were always accompanied by the black vapoury shroud, which hid every thing else from view, and added greatly to the lustre of their exodus from the horizon.

Having made the foregoing sketch, I again returned to view the Aurora, which had somewhat changed its appearance.

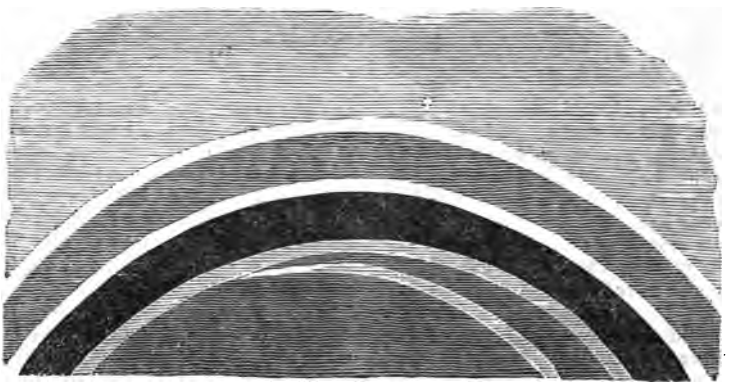


Both arcs or belts were now less distinct, the lower one almost obliterated, but still its place was well marked by the arch of vapour below, which was darker than ever. Three large spots of intense light now displayed themselves, one on the horizontal chord, and one on each side of the lower arch, whilst this lower zone shot out innumerable pencils and floods of light from its dark nucleus, the upper zone also darting forth long lines of brilliant rays; all these rays from both hands moving in a very stately march or progression from east to west.

Towards the southern and western portions of the heavens, all was clear blue-black star-light, Orion being particularly brilliant; the north was as if overspread with a thin veil, through which the stars were barely visible.

I watched these alterations of the phenomenon until after ten; and the last I observed presented this form; after which the arches became less distinct, and eventually, with the exception of the great arch, passed away.

In this fourth change the Aurora, it will be observed, resumed its three arches, but they were no longer concentric, the third being broken on the right into a portion of a fourth. Between the second and third the darkness was the darkness of blackness, whilst the third arch was light itself; but the lower arches were not so bright, and the lower nucleus was only darkish, which was contrary to every state that it had presented, under any former observations, for several years.



The constant arch of the Aurora of the lakes has, I believe, never been noticed in any scientific publication as is well worthy the attention of the learned. Whether it is created by a peculiar locality of the matter of which the substance of the Aurora is composed, or whether the Aurora itself, as the magnetic influence, has a peculiar pole from whence its effluences emanate, can scarcely be, at present, determined; but it is, at all events highly singular, that in a latitude so low as 44°, the Aurora should assume forms unknown in the higher northern regions, where its powers were hitherto supposed to have developed themselves in the highest possible state.

Not having been very well when this singular scene occurred, I did not take all that notice of it which it deserved. I trust I shall be able during the winter to note the atmospheric phenomena which accompany it, more particularly, as well as to give more detailed accounts, and more perfect drawings.

II. *Solar Phenomenon.*

Immediately previous to the alteration of the weather at Kingston, on Lake Ontario, after an unusual duration of severe frost, and about the middle of March, at near four o'clock in the afternoon of Sunday, I observed a singular species of halo or rainbow.

The day was mild, and there was scarcely any wind, and no rain, but the face of the sky was overclouded, and the sun appeared as it does through a slight fog.

Around the luminary, at a radial distance of perhaps twenty degrees there was a dark halo of the usual defined character and appearance; and circling this halo in various places, a rainbow was visible. This rainbow was brightest in the eastern and western parts of the halo, where it assumed that peculiar appearance which seafaring men call weather-dogs, and which are of very frequent occurrence in the northern division of the Atlantic Ocean.

It was evident from the dull whitish light that was diffused about those portions of the circumference of the halo on which the prismatic colours were not perfectly defined, that, in some situations, an observer might witness the singularly interesting spectacle of a circum-solar rainbow, in which the prismatic colours formed a complete circle, concentric with the sun.

In the course of the winter season, during changes of the weather from frost to a thaw, I have frequently observed a small portion of a vertical arch of the above description, although the sun was hardly visible. Usually these occurrences have taken place when the sun has been at the same elevation as in the instance here described. They have always happened when there was no rain.

I am unable to say whether the appearances might not be created by reflection from the brilliant surface of such a vast body of ice, unincumbered by snow, as has been presented by Lake Ontario during the last winter, as it is difficult to account for the formation of a rainbow of so small a diameter on the usual principles, since the sun at the time was forty degrees above the horizon.

I have used the word rainbow in the above description, although it is not a correct one, as there were no appearances of rain during the presence of the phenomenon, although it is true there was a slight mist or fog.

Since writing the above, I have seen an almost complete circum-solar rainbow, which appeared at Toronto, Upper Canada, July, 1834, at seven in the morning.

MR. MACKINTOSH'S LECTURES ON HIS ELECTRICAL THEORY OF THE UNIVERSE.

On Monday, the 3rd instant, at the "Hall of Science," City-road, Mr. Mackintosh delivered the first of a series of lectures on the "Electrical Theory of the Universe," which are to be continued every Monday evening. In the course of his introductory observations, he instanced some striking analogies from the vegetable and animal kingdoms, tending to prove that every thing in nature, of which we have any knowledge, has a birth, rises to maturity, and gradually declines to a final dissolution.

In the vegetable kingdom, he remarked, the young shoots of plants are mere collections of sap, vessels of the most delicate, soft, and pulpy texture, which are filled with juices in a state of the most active circulation; as the plant advances to maturity, the soft pulpy texture hardens into solid timber, and the circulation of the juices is less active; as the tree declines, the cellular texture continues to fill with solid matter, by which the circula ion is impeded, until at last the circulation is stopped, and the plant dies and falls to the earth a piece of dry dead, inert, matter.

In the animal kingdom the same arrange-

ment of circumstances prevail; the muscle of the young animal is soft and juicy, the bone is mere cartilage; the same process goes on as in the vegetable: at mature age the cartilage is hardened into solid bone, and the muscle is firm and compact; as old age creeps on the bones become hard and brittle, the flesh begins to ossify, the circulation is impeded more and more, and is at length entirely stopped by the ossifying process, and the animal dies of extreme old age.

These are the natural processes, from birth to death, in the animal and vegetable kingdoms, provided the constitution of the animal or plant is sound and good; and provided, also, that they escape the casual diseases and accidents incident to animal and vegetable life.

Mr. M. next proceeded to show that the earth itself is undergoing the same ossifying process; that that, which was once the soft and friable surface of the earth, is now composed of hard and impenetrable marble, in which are found the remains of animals and plants thereby proving, beyond all controversy, that that bed of marble must have been at a former period composed of soft and yielding materials.

On these principles he proceeded to contend, that at a remote period the earth existed in the soft, loose, aeriform state of a comet, that the process of condensation or ossification has been going on from the beginning, and will continue to go on until at last the whole earth will be converted into solid stone, and in that condition it will fall back into the sun, to be again converted into aeriform matter, and so on, *ad infinitum*.

The lecture for Monday next treats of the *laws* and *sources* of motion, which must be of special interest in the present age of steam-carriages and railroads, and will no doubt be handled in a manner equally original.

GREGORY'S IMPROVED WINDOW-CLEANER AND FIRE-ESCAPE.

Sir,—I took occasion, when introducing Mr. Ford's excellent fire-escape to your readers,* to notice the apathy of the public generally to the exertions of science in the cause of humanity; in addition to the instances then adduced, another, which might with great propriety have been quoted, is the safety window-cleaner of the ingenious Gregory.

It is now upwards of seven years since I first noticed this valuable contrivance in your pages,† and I regret that since its publication, but few comparatively have been employed; in the interim, various improvements have been introduced, all tending greatly to increase its convenience and usefulness. It is truly lamentable to hear of the accidents that are continually happening in the metropolis from the want of some such contrivance as this, for the protection of servants while cleaning the outside of windows. A recent calamity of this kind called forth the following remarks which appeared in the *Morning Herald* newspaper about a fortnight ago:—

"*Destruction of Human Life by Window-cleaning.*—The very inhuman practice of compelling female servants to clean the windows of their employers, though not punishable by our laws, certainly ought to be subjected to certain legal penalties by fine or imprisonment; in the first place, the party should be smartly fined, for ordering, or even permitting any house-servant, male or female, to clean the windows of their premises; and should the want of decency and Christian feeling compel their servants to do this illegal act, and should the servant be severely injured in consequence of obeying such orders, then the law should compel the employer to maintain the party until quite able to earn their bread; but in case the servant should fall and become a victim to the violent and cruel death which inevitably follows, then the employer ought to be handed over to a criminal tribunal, to be tried for the crime of manslaughter, and if convicted, then condemned to imprisonment for any term not less than one month, nor more than two years, according to the nature of the offence; a very few cases of such punishments would, we are quite certain, put a stop to this growing enormity, which, instead of being laid aside as barbarous and cruel, appears to increase in a frightful degree; so much so, that we can hardly go through a street of any length without being pained with the sight of some poor servant, generally a female, dangling on the window-sill of what is, *par excellence*, denominated "the drawing-room," or the second floor window; and on three several occasions have we been horror-struck by seeing those devoted victims of a miserable and inhuman spirit of economy, precipitated to the pavement, or transfixed upon the iron spikes of the railings before the house, whilst the heartless employers looked on with more indifference than if a favourite cat or monkey had been the sufferer. We ask, again, is this cruel and degrading practice to be still suffered to exist in Christian England?—a practice that destroys annually a greater number of innocent persons by a torturing death, than are de-

* Vide vol. xxv. p. 130.

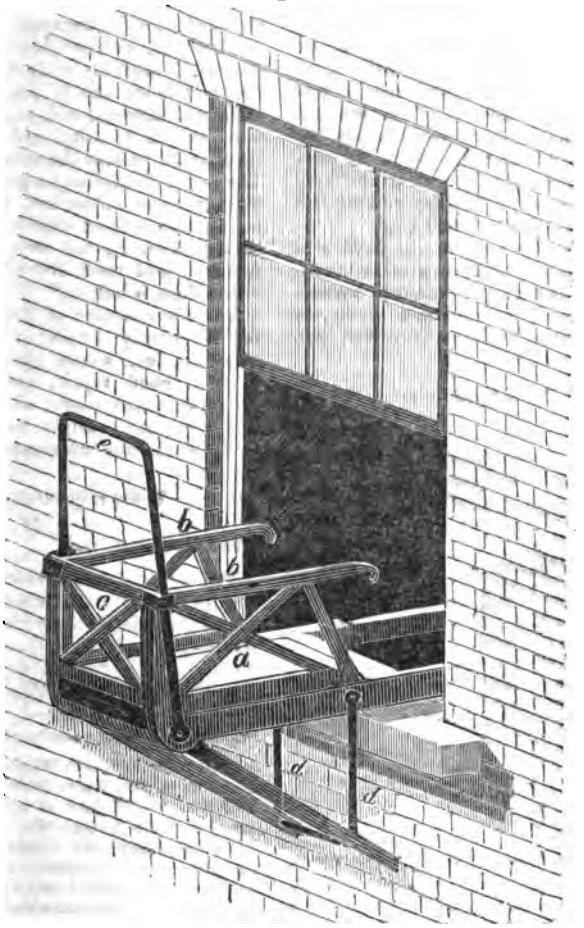
† Vol. ii. p. 248.

stroyed in the same time, by the arm of the penal code, for crimes of violence and blood! Another victim to this poverty-stricken economy has just been sent to the Middlesex Hospital, having fallen from a window, forty feet from the ground, in Golden-square. As the poor girl is not likely to recover, we hope the Coroner's Jury will lay a heavy deodand upon the window as the cause of her death. Juries ought to use their power in such cases; if they do not, it will be indispensable to make this offence a criminal one."

Although strong, this language is by no means stronger than the occasion requires, and it is to be hoped, that the public press will be able to put a stop to the practice of compelling servants to clean the outside of windows *without some adequate protection*.

The accompanying drawing, fig. 1, represents Gregory's safety window-cleaner in use; it consists of a floor, *a*, with two sides *b b*, and a back *c* hinged to it. On the under side a frame with two legs is connected with the floor of the machine

Fig. 1.

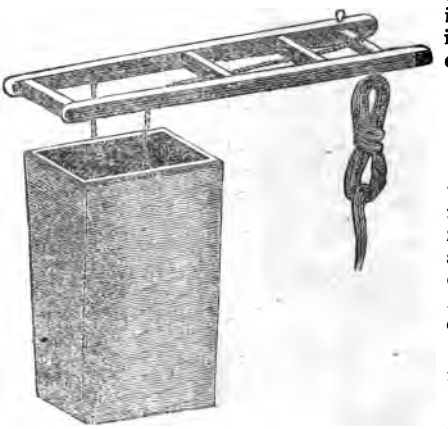


by a hinge joint and by the folding irons *d d*. The sides, back, &c. fold down flat upon the floor, and the legs folding up underneath, the machine assumes

such a compact form as to occupy but little space, and to be carried from room to room, as required, with the utmost facility. When necessary to be used, the sides are first set up, and then the back, which catching hold of a spring on either side, becomes perfectly firm, and is still farther secured by the binding-iron *e*, which also catches a spring on either side, and the whole becomes firm and immoveable. Females or others may stand within this portable balcony, and perform the external cleaning of windows with as much safety as they now do the interior. The machine is secured to the window-sill by a couple of legs, sliding on the arms which project within the room, and fixed at a suitable distance by iron pins. So far the contrivance is admirable, but perhaps one of the greatest improvements made in this machine by its talented inventor, has been its conversion into a very convenient and very efficient *fire-escape*, thereby making it a life-preserver of a two-fold kind.

For the latter purpose the floor *a* is made moveable, and being taken away, the apparatus (fig. 2) is inserted, consisting of a wooden frame and cradle, in which females, children, invalids, &c. may be lowered in safety.

Fig. 2.



The cradle is suspended by two ropes, which pass up through the sides of the frame, then through two of the cross bars, and can afterwards be passed once or twice round the last bar, which is hinged on for the purpose, so that sufficient friction may be generated to permit the descent to be safely made by the individuals themselves without any extraneous aid. The cradle can be lowered either by the persons within it, by those above, or by assistants in the street, according to circumstances.

Within the last three weeks a gentleman has been severely injured by precipitating himself from an upper window to save his life from destruction by fire; and within the last week a female has lost her life by throwing herself and her child from a window of her burning habitation, within a few yards of a police-station and of a fire-engine station provided with fire-escapes, &c.

After this, and numberless similar instances, it must be evident that little or no dependance can be placed upon the chance of *external aid*, and that, to obtain perfect security, individuals must themselves provide the means of escape. The two-fold advantages possessed by the machine now submitted, renders it, in my opinion, a most eligible and effectual life-preserver against two of the most frequent and most distressing accidents "that flesh is heir to."

The circumstance of the machine being frequently employed for window-cleaning, &c., would ensure its being kept in good repair, and would also render its management so familiar, that in one minute it might be set up, even in the dark, and an escape immediately effected.

Yours respectfully,

W. BADDELEY.

London, Sept. 15, 1836.

P.S.—Since the above communication was in the printer's hands, another lamentable accident has occurred—another fellow-creature been sacrificed to the abominable practice of *unprotected* window-cleaning. The *Morning Herald* of Monday last contained the following comment on this catastrophe:—

"*Another Victim to Window-cleaning.*—It is not more than ten or twelve days since we had the painful duty of recording the destruction of a human life, by a species of homicide which, we believe, is unknown, except in our 'Christian' and 'benevolent country.' This cruel and wanton species of homicide, which disgraces the British character, is unhappily not recognised as a crime, or even a misdemeanour, by our criminal code, which, though lately sanguinary to a most revolting degree, and even in its miti-

gated form, is too deeply stained with the purple tide of human existence, does not provide the least penalty for those cruel and unfeeling persons, who, in spite of all that is just, decorous, and humane, compel their unfortunate servants to mount upon the *window-sills* of their houses to clean their windows, and by which inhuman order the servants frequently lose their lives in an awful and cruel manner. The young woman, Pemberton, who was so dreadfully mangled on Thursday last by falling from the second floor window of a house in Charlotte-street, Fitzroy-square, it is said, was not ordered by her master or mistress to clean their windows. This may be true, but it is not very probable; and the truth or falsehood of the statement is likely to rest until the day of judgment in the tomb with the poor sufferer, for it is as much hoped for as expected that she has been by this time relieved from her sufferings. But how dreadful must be the feelings of any employer whose servant is thus destroyed, through obeying their strict commands; and it is well known that servants are almost always averse to this indecent and dangerous experimental economy; they are generally compelled to go upon this murderous employment from threats of being discharged from their situation, and many a respectable servant is turned out of employment because they will not submit to the degradation of exposing themselves on the outsides of houses, and to the danger of being dashed to pieces, to save, perhaps, 1s. to a needy or penurious economist; such economic barbarians seeming to consider a paltry sum of more value than the life of a fellow-creature. But it is remarkable that the Coroner's reporter, or penny-a-line man, always finds out that 'the master and mistress are very respectable people, and not at all to blame in the matter.' It is very well for these parties, no doubt, when this is the case; but the common sense of mankind runs directly against the finding of those sub-adjuncts of the Press, the presumption, and the fact too, being, that in nineteen cases out of twenty, the employers are *not* respectable, and *are* blameable. We should think that any person possessed of the ordinary humane and Christian feelings of our nature, would prevent any servant who was foolish enough to desire such a job, if they were aware of it. But there is a way of putting a stop to this inhuman practice, and that is by making it a criminal offence, as it undoubtedly is in the eyes of the Almighty; it classes with the unjustifiable homicides, and should be punished by various terms of imprisonment, with hard labour, according to the atrocity of the case, and we hope another Session will not pass without an Act to protect servants from such cruel tyranny, and to punish, in a summary manner, any employers who may be atrocious enough to persist in such an inhuman practice; and we do advise all house-servants, especially females, to refuse, if any employer should, after this, be hardened enough in cruelty to order them to do this act, which does not belong to the duties for which they are hired."

MR. CROSSE'S GALVANIC AND ELECTRICAL APPARATUS.

In the *Brighton Herald* of Sept. 24, appeared, "An Account of Sir Richard Phillips's Visit to Andrew Crosse, Esq., of Broomfield, in the Quantock Hills, Somersetshire, in September, 1836." Passing over a great deal of Sir Richard's preliminary twaddle (who, it will be seen, claims to have anticipated Mr. Crosse), we now lay before our readers his description of the extensive and splendid galvanic and electrical apparatus fitted up by Mr. Crosse, which is exceedingly interesting:—

"On reaching the handsome mansion of Mr. Crosse, I was received with much politeness, and found that I was the first visitor from Bristol. After breakfast, Mr. Crosse conducted me into a large and lofty apartment, built for a music-room, with a capital organ in the gallery; but I could look at nothing but the seven or eight tables which filled the area of the room, covered with extensive Voltaic batteries of all forms, sizes, and extents. They resembled battalions of soldiers in exact rank and file, and seemed innumerable.

"They were in many forms. Some in porcelain troughs of the usual construction; some like the *couronnes des tasses*; others cylindrical; some in pairs of glass vessels, with double metallic cylinders; besides them, others of glass jars, with stripes of copper and zinc. Altogether, there were 500 Voltaic pairs at work in this great room; and in other rooms about 500 more. There were besides other 500 ready for new experiments. It seemed like a great magazine for Voltaic purposes.

"There are also two large workshops, with furnaces, tools, and implements of all descriptions, as much as would load two or three waggons.

"In the great room there is also a very large electrical machine, with a 20-inch cylinder, and a smaller one; and in several cases all the apparatus in perfect condition, as described in the best books on electricity. The prime-conductor stood on glass legs, 2 feet high; and there was a medical discharger on a glass leg of 5 feet. Nothing

could be in finer order; and no private electrician in the world could, perhaps, show a greater variety both for experiments and amusement.

"Beneath the mahogany cover of a table, on which stood the prime-conductor, &c., was enclosed a magnificent battery of 60 jars, combining 73 square feet of coating. Its construction, by Cuthbertson, was in all respects most perfect. To charge it required 250 vigorous turns of the wheel; and its discharge made a report as loud as a blunderbuss. It fuses and disperses wires of various metals; and the walls of the apartment are covered with framed impressions of the radiations from the explosion, taken at sundry periods. Mr. Crosse struck one while I was present; and he has promised me one as an electrical curiosity, and a memento of my visit.

"But Mr. Crosse's greatest electrical curiosity was his apparatus for measuring, collecting, and operating with atmospheric electricity. He collects it by wires the sixteenth of an inch, extended from elevated poles, or from trees to trees, in his grounds and park. The wires are insulated by means of glass tubes, well contrived for the purpose. At present he has about one-fourth of a mile of wire spread abroad; and in general about one-third of a mile. A French gentleman had reported to the Section at Bristol, that the wires extended 20 miles, filling the entire neighbourhood with thunder and lightning, to the great terror of the peasantry, who in consequence left Mr. Crosse in the free enjoyment of his game and rabbits. This exaggeration Mr. Crosse laughed at most heartily, though he acknowledged that he knew that no small terror prevailed in regard to him and his experiments.

"The wires are connected with an apparatus in a window of his organ-gallery, which may be detached at pleasure, when too violent, by simply turning an insulated lever; but in moderate strength it may be conducted to a ball suspended over the great battery, which connected is charged rapidly, and is then discharged by means of an universal discharger. He told me that sometimes the current was so great as to charge and discharge the great battery 20 times in a minute, with reports as loud as cannon; which, being continuous, were so terrible to strangers that they always fled, while every one expected the destruction of himself and premises. He was, however, he said, used to it, and knew how to manage and control it; but when it got into a passion, he coolly turned his insulating lever, and conducted the lightning into the ground. It was a damp day, and we regretted that our courage could not be put to the test.

"Every thing about this part of Mr. Crosse's apparatus is perfect, and much of it his own contrivance, for he is clever in all mechanical arrangements, and has been unwearied in his application, almost night and day, for thirty years past. I learned, too, that in the purchase and fitting up of his apparatus he has expended nearly 3000*l.*, although in most cases he is his own manipulator, carpenter, smith, coppersmith, &c.

"About 12, Professor Sedgwick arrived, and in the afternoon one or two others, besides seven or eight gentlemen of the neighbourhood, who had been invited to meet us at dinner, for Mr. Crosse unites to the rank of esquire that of a county magistrate, in the duties of which he is respected alike for his humanity to the poor and for his liberal opinions in politics. Mr. Crosse himself was educated at Oxford; and his second son holds the living of Broomfield. He is master of all his father's experiments; and, in spite of the complaints of an Oxford education, I found him to be a very expert mathematician, well read, and variously accomplished. We next morning renewed our survey, previous to fresh arrivals, and I took notes of every thing connected with his aqueous Voltaic batteries, in the following order, errors excepted:—

"1. A battery of 100 pairs of 25 square inches, charged, like all the rest, with water, operating on cups containing 1 oz. of carbonate of barytes and powdered sulphate of alumine; intended to form sulphate of barytes at the positive pole, and crystals of alumine at the negative.

"2. A battery of 11 cylindrical pairs, 12 inches by 4. This, by operating six months on fluat of silver, had produced large hexahedral crystals at the negative pole, and crystals of silica and chalcedony at the positive.

"3. A battery of 100 pairs, of 4 square inches, operating on slate 832, and platina 9, to produce hexagonal crystals at the positive pole.

"4. A battery of 100 pairs, 5 inches square, operating on nitrate of silver and copper, to produce malachite at the positive pole; at the negative pole crystals already appear with decided angles and facets.

"5. A battery of 16 pairs, of 2 inches, in small glass jars, acting on a weak solution of nitrate of silver, and already producing a compact negatation of native silver.

"6. A battery (esteemed his best) of 612 pairs, 5 inches, insulated on glass plates on deal bars, coated with cement, and so slightly oxydated by water as to require cleaning but once or twice a year by pumping on them. I felt the effect of 458 pairs, in careless order and imperfectly liquidated, and they gave only some tinglings of the fingers; but this power in a few weeks produces decided effects.

"7. A battery of 12 pairs, 25 inches zinc and 36 copper, charged two months be-

fore with water, and acting on a solution of nitrate of silver, poured on green-bottle glass coarsely powdered. It had already produced a negatation of silver at the positive pole.

"8. A battery of 159 galley-pots, with semi-circular plates of 1¼ inch radius, placed on glass plates, and acting five months through a small piece of Bridgewater porous brick, on a solution of silex and potash. I saw at the poles small crystals of quartz.

"9. A battery of 30 pairs, similar to No. 8, acting since 27th July on a mixture, in a mortar, of sulphate of lead, of white oxide of antimony, and sulphate of copper, and green sulphate of iron (205 grains), and three times the whole of green-bottle glass (615 grains). The result has been, in five weeks, a precipitation on the negative wire of pure copper in two days, and crystallised iron pyrites in four days. It had been expected to produce sulphurets of lead, copper, and antimony, by depriving the sulphates of their oxygen. On August 10th and 28th, 25 grains and 40 grains of sulphate of iron were added.

"10. A battery of 5 jars, with plates of different metals, as 2 copper and platina, 1 lead and lead, 1 silver and iron, and 1 copper and lead. Experimental.

"11, 12, and 13. About 200 pairs, in 3 batteries, working in a dark room, of which I took no note.

"While I was an inmate with Mr. Crosse, we had various conversations about the power which he employed. I had in some degree anticipated his *début*, by hazarding, in the last edition of my 'Million of Facts' (1835), an assertion that, inasmuch as metals are found only in a mixed or confused state of different rocks, among which a galvanic action on air or water would necessarily arise, and in long time generate the compound or matrices of metals; but I did not regard this public anticipation as any interference with his original merits, and I was deeply penetrated by the view of his labours and the expense and zeal with which he had prosecuted his experiments. Yet he had a round conductor for a minimum of power, instead of a combination of flat or parallel ones for a maximum. And he could not help talking about the fluid and some other fancies of the elder electricians, who invented their doctrines before it was suspected that air was a compound, and that such active powers as oxygen, nitrogen, hydrogen, and their definite numerical co-mixtures, conferred mechanical character on the most refined operations of nature.

"He instructed me in the fact, that his batteries performed four times the duty in those hours in the morning, from seven to eleven, when the great laboratory of nature is evolving the most oxygen—than in the same period in the evening, when we may imagine the contrary effect takes place. He considered the air as so non-electric in damp weather, that no plate of air lying between the coating of a cloud and the earth could then be disturbed; and he stated to me, as a general fact, that the earth is always positively electrified.

"On my part, I enlarged to him and his son on the universality of matter and motion in producing all material phenomena, independently of the whimsical powers invented in ages when we would have been burnt for a magician; and in this way I endeavoured to return the various information which he had unreservedly imparted to me. I impressed on him, that all this creative energy of atoms was merely a display of developments by the great motions of the earth as they affect the excitable parts of different solid bodies; the results of which are necessarily regular, and their ultimate laws of re-action and combination also regular, so as to produce that universal harmony which surprises beings, who in eternal time live and observe within only a unit of time. Hence that terrestrial galvanism, arising from the operations of the internal frictions and varied pressures called heat; hence those factitious productions of metallic matrices and crystalline galvanic effects, where different substances are proximately opposed; hence magnetism itself, tangentally displayed as a resultant of terrestrial currents of electricity; hence the fluctuations of the phenomena from obliquity of the axis of rotation, which in regard to the axis of the orbit generates two variable directions of massive pressure; hence, in fine, the wisdom displayed by Mr. Crosse in resorting to the *modus operandi* of Nature in his attempts to imitate her most curious productions.

"Observing that continual fresh arrivals rendered it ineligible for me to prolong my visit, I proceeded to Taunton, a distance of six or seven miles, the nearest place at which a stranger can meet with public accommodation."

MESSRS. SYMINGTON'S AND HOWARD'S SYSTEMS OF CONDENSATION.

Sir,—If Mr. Howard feels inclined to take a jaunt to Tedworth, near Andover, he will there, in all probability, see what I saw on the property of T. A. Smith, Esq., M.P., a method of condensation, "by withdrawing the warm water from the condenser, and injecting it again amidst the steam—the heat in the mean time having been abstracted from it—in

which a very rapid and effectual condensation of the steam, with the advantage of continually returning to the boiler the same water, or nearly so, is effected." And if he be not satisfied with this proof of his having been rather hasty in his proceedings, I would recommend him to travel a little farther northward, and he will find what he terms his method, principle, or process, has been in use for forty years in Messrs. Lock, Blackett, and Co's., white lead and shot manufactory, Gallowgate, Newcastle; where may also be seen the very ingenious *method* in which they have availed themselves of a *principle*, the refrigeration of shot, by allowing it to drop into a pit or "well," instead of letting it fall from a tower or "garret."

When Mr. Howard has from ocular demonstration or unquestionable authority rendered himself able to disprove my statements, I may, if called upon with courtesy, answer his various questions; but if he do not diminish very considerably the authoritative tone he has thought proper to assume, he may call, but I will not answer—leaving the question to the judgment of those who may have examined the drawings accompanying our specifications,—openly avowing that I think my method infinitely more simple and convenient than Mr. Howard's; and observing, that to lose temper is no sign of being in the right.

I remain, Sir,

Your most obedient servant,

WILLIAM SYMINGTON.

1, King William-street, Sept. 30, 1836.

NOTES AND NOTICES.

Cannons.—We long since stated (says Galignani) that a commission had been sent to England and Scotland, with a view to examine the superiority of the iron cannon manufactured there over the brass ones at present used in the French service. The Report was, we learn, favourable, but the Government have resolved not to determine the question until after a course of experiments made under the direction of a commission appointed for that purpose. They have invited the Swedes and English to the trial, with nine cannon of different dimensions cast after patterns sent from France. The Belgian Government having judged that Belgian iron would well bear the competition with that of England and Sweden, has also entered the field as a competitor, and several cannons cast at Liege have been sent to La Fere, where they are to be proved

Alarm-Lamp.— A gun-maker of Easingwold, Yorkshire, has invented an alarm-lamp to replace spring guns, which it is no longer legal to make use of. The inventor states, that the lamp may be placed against a tree or post in a stack-yard, or in any place where property is kept; and if any one comes within its limits, it lights up and fires fifteen or twenty reports, which may be heard at some miles' distance. When used for preserves, it may be made to send up a skyrocket, to show in what direction the poacher may be found. It is described as being perfectly free from danger to servants or others having the care of it, but said to be calculated when it goes off to strike terror into the breast of the most audacious depredator.

Railway Travelling by Wind.—Since the opening of the Durham and Sunderland Railways, a novel experiment has been tried upon the line, which proves the practicability of railroad vehicles being propelled by wind. A temporary mast and sail were erected on a vehicle, which was set going at an easy rate. On the sail being trimmed to the wind, the speed increased to the rate of ten miles an hour. A train of five coal-waggons was afterwards attached, but no additional sail hoisted.

Peat Tiles for Draining.—A Mr. Calderwood, of Blackbyres, Fenwick, has invented a spade to cut peat tiles in a most expeditious manner. These tiles are shaped something like a clay tile, and on moor-lands will answer the purpose equally well. In such districts clay is not to be had, and the expense of carting tiles would be heavy. With the newly-invented spade a farmer may cut two or three thousand tiles a day, expose them to dry in the sun, and lay them in his drains within a few yards of the place where they were cut. When properly dried, they will be porous, and will not soften with wet. Mr. Calderwood would confer a benefit on the agriculture of the country by making public a description of his invention.—*Scotch Paper.*

Mr. Crosse's Galvanic Experiments.—We have just been informed, says the *Plymouth Gazette*, that Dr. Simon of this city has been favoured with the following communication from Mr. Crosse:—"Since I left Bristol I have formed red sulphuret of silver and crystallised arsenate of copper; and caused the magnetic needle to be deflected eleven degrees from the north by a pair of cylinders composed of copper and zinc, with *water alone.*"

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

A complete list of Patents from the earliest period (15 Car. II. 1675,) to the present time may be examined. Fee 2s. 6d.; Clients, gratis.

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BRAITHWAITE'S STEAM FLOATING FIRE-ENGINE.

Fig. 1.

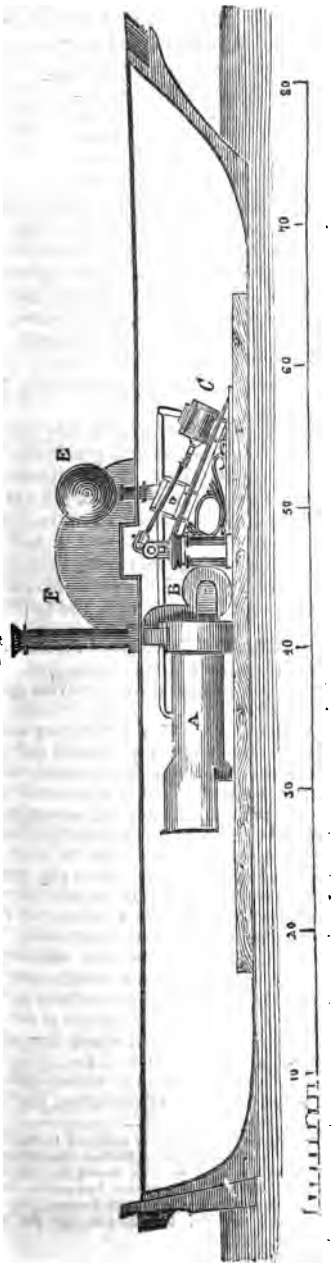
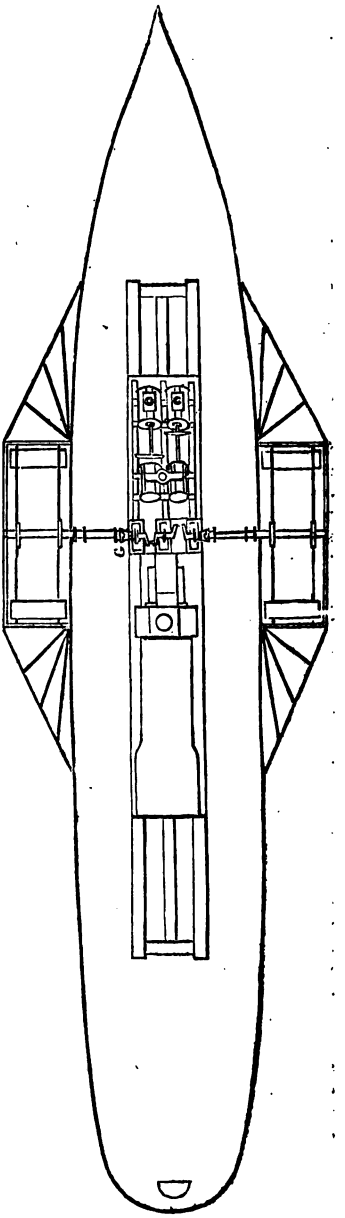


Fig. 2.



BRAITHWAITE'S STEAM FLOATING FIRE-ENGINE.

We have much pleasure in being able this week to lay before our readers a description of Mr. Braithwaite's floating fire-engine, referred to in our note to the article on the "House-burning System," extracted from the *Spectator* into our 684th Number, and mentioned as having been submitted to the Associated Fire-offices, but its adoption declined by them. Although it must be acknowledged, as our indefatigable and respected correspondent, Mr. Baddeley, observes, that fires are *sometimes* extinguished by the common fire-engine, under the management of the Fire-Brigade, yet the effect of these manual machines must be small in comparison to that of a flood of from four to five tons of water per minute; which Mr. Braithwaite assures us can be delivered by the engine now described.

It will be seen, that the machinery of the floating steam fire-engine is so arranged, that the power of the engines can be at once changed from propelling the vessel to working the pumps. Thus its locomotion does not depend either upon wind or tide; although its power can, of course, be used with greater efficacy when a high tide permits its close approach to the burning building. In cases of accidents from fire amongst shipping, its aid would be invaluable; and we are surprised that ship-owners have not, as yet, perceived the protection which would ensue from the addition of one, at least, to each of the different sea-ports of the kingdom.

The steam can be got up, and every thing ready for working, in twenty minutes from the time of the alarm being given. The gearing of the coupling-boxes is then connected with the paddle-wheels, by which the vessel is propelled until it arrives in the vicinity of the fire, when the gearing is altered, and the engines brought in connexion with the pumps.

In our front-page engraving, fig. 1 is a section, and fig. 2 a plan of the floating-engine. A is the boiler (on Braithwaite and Ericsson's patent principle); B, the exhauster; C, the steam-cylinder; D, the water-pumps; E, the air-vessel; F, the paddle-box; G G (fig. 2), are the coupling-boxes, or gearing, for engaging and disengaging the paddle-wheels and pumps.*

The pumps are double-acting, and capable of throwing from four to five tons of water per minute through branch-pipes with jets as follows:—

3	jets of	1¼ inch bore.
4	do.	1¼ ——
5	do.	1⅛ ——
7	do.	1 ——
9	do.	⅞ ——
12	do.	⅞ ——

The boat is of wrought-iron, and with the machinery, water in the boiler, pumps, air-vessel, and every thing complete, weighs 37 tons. The engines being 30-horse power, will propel the boat, drawing 2 feet water, at the rate of about 9 miles per hour. The length of the boat, 80 feet; height, 11 feet; breadth of beam, 13 feet; under decks, 7 feet, 4 inches.

The necessity of any further remarks of ours upon the subject is precluded by the following letter of Mr. Braithwaite's to the Editor of the *Spectator*, in answer to the article before referred to, in that publication. We fear there is too much truth in the short and pithy note of "An Observer," which follows Mr. Braithwaite's—"the sting is in the tail."

"To the Editor of the 'Spectator.'

...."A steam fire-engine which performed wonders: what has become of it?"—Vide *Spectator*, 11*th Sept.*

"Mr. Editor,—I will tell you what has become of it; but first permit me to give you a short history of its existence, as without it you cannot be in a situation to deal out even-handed justice as between me (the projector and inventor) and the Fire Insurance Companies, who have failed to avail themselves of it, as a means more sure than any other now in application for subduing fires.

"Having taken out a patent for an improved method of generating steam, I was induced, amongst other uses which it suggested, to attempt the construction of a *steam fire-engine*; and succeeded in perfecting one of *ten-horse power*, capable of delivering, with unexampled effect, *ninety tons* of water per hour. I then invited the Directors of the different fire-offices to witness its effects; who, on seeing it in operation, one and all

* We have here merely referred to the different parts of the apparatus; a further elucidation of its mode of working will be found in the description of Braithwaite's steam fire engine in *Mech. Mag.*, No. 350, and of the "Comet" fire-engine, built also by Mr. Braithwaite for the King of Prussia, No. 428.

expressed themselves astonished and delighted. Some, fearing an engine of such power would require more water than could be supplied to it, suggested that one *of less power, and more portable*, would be more serviceable. Up to that time I had expended about 1700*l.* in perfecting it; but, nothing daunted, I adopted the suggestion, and constructed another to be drawn by two horses; and which, by appointment, was taken to the Regent's Canal Basin. In thirteen minutes from the fire being first lighted, the steam was up at 50 lbs. pressure; and the whole in operative delivery, projecting a column of water a distance of 130 to 140 feet, and 80 feet high, at the rate of 45 tons per hour. Nothing but satisfaction was expressed by all. Shortly afterwards, the Argyll Rooms being on fire, offered an opportunity for practically displaying its merits. The weather was extremely severe; and whilst the ordinary engines were soon frozen and rendered incapable of working, my engine continued for five hours so efficiently to perform its task, that but for its presence property to an immense amount must have been destroyed. Then came the fires in Wells-street, Charles-street, Soho, the English Opera-house, Messrs. Barclay and Perkins' brewery, at each of which it was at work, and at many others of less magnitude. The superior merits of the steam fire-engine over every other, all admit; but to myself, beyond the thanks of owners of property on the spot, and the liberal treatment, I am happy thus publicly to acknowledge, I and all my people received from the hands of Messrs. Barclay, Perkins, and Co., and one sovereign given to my men (who attended at a fire with my engine) by Mr. Braidwood, Superintendent of the Fire-Brigade, I have neither received reward nor encouragement—nay, until the New Police was introduced, nothing but obstructions and annoyances. My last effort was, by the advice of some influential friends, to prepare drawings and estimates for a float-engine on the river. I did so; and, at the instigation of some of the Directors, I submitted them to the Committee managing the new Fire-Brigade establishment; who, after some few days, returned them to me by Mr. Braidwood, the Superintendent, with the following letter:—

'28, Watling-street, 14th Sept., 1835.

'Sir,—I am directed by the Committee for managing the London Fire-engine establishment, to return you their best thanks for the sight of the plans you have been kind enough to favour them with; and to inform you that they do not deem it advisable to execute them at present; but, should they do so at any future time, they will be most happy to have your valuable assistance.

'I have the honour to be, Sir,

'Your most obedient servant,

'JAMES BRAIDWOOD, Superintendent.

'—— Braithwaite, Esq.'

"On the above statement I will make no comment; leaving the public themselves to judge of the whole matter. As things at present are, I am minus about 3500*l.* by my invention.

"Now, for the answer to your question as to what has become of the engine? Finding I must expect no support from the fire-offices, I have been applying it, rather than permit it to remain idle, to various purposes of pumping; and at the time of the fire in Tooley-street, it had been home but a few days, and was undergoing slight repair. Will the fire-companies say why they have not adopted it? An answer to this question is as much due to the public as to me.

"I am, Sir, your obedient servant,

"J. BRAITHWAITE.

"P.S.—The Floating Fire-engine you call by my name, I claim no merit in, for in its construction I had nothing to do; mine being a *steam* fire-engine, whilst that requires the labour of forty men, constantly relieved every ten minutes, to work it effectually.

"*To the Editor of the 'Spectator.'*

"Mr. Editor,—It is well for you you were not born in the days of Herod, or you would most surely have been cut off with the other innocents. Do you really imagine the fire-companies wish *all fires* to be put out quickly? No, no—they are not such fools as you take them for. Are you not aware that property destroyed, not insured, is a godsend to them—the timid flocking by wholesale the next day to effect insurances? I am sure, from your very simplicity, you are not a Director of any of the Companies 'yclept fire-insurance.

"Your obedient servant,

"AN OBSERVER."

"[Mr. Braithwaite's letter comes in timely proof that An Observer is right, and that we are—'innocent.'—ED.]"

ON MACKINTOSH'S ELECTRICAL THEORY OF THE UNIVERSE, AND OUTLINES OF ANOTHER THEORY. BY COLONEL MACERONI.

Letter I.

Sir,—In common, I dare say, with the far greater portion of your readers, I have derived much satisfaction from the perusal of Mr. Mackintosh's papers on the Electrical Theory of the Universe. After reading his two first letters, I stated to you my intention of offering some remarks on the same subject. Since then I have thought it expedient to await the further development of Mr. Mackintosh's ideas.

For these many years past I have, through the process of observation, comparison, experiment, and meditation, arrived at many of the convictions expressed by Mr. Mackintosh; and I have arrived at others which greatly differ from those generally inculcated in the schools, but more or less approaching to Mr. Mackintosh's theory.

Before I enter into the more immediate purport of this letter, I will advert to a very minor point, in which I do not agree with Mr. Mackintosh, at least, not to the extent to which he takes it. In No. 676, he says, that "*he* is, as well as the astronomers, much perplexed in their endeavours to account for the brilliant appearance of the *moon* and planets, and cannot conceive it to result from the reflection of the sun's rays from mere earthy matter." In No. 160 of the *Mechanics' Magazine*, may be seen an article of mine, "On the Light and the Atmosphere of the Moon;" but as Mr. Mackintosh, and others of your readers, may not be able to lay their hands on that Number, I will just repeat an outline of the observations I make therein on the subject of *reflected* light. First, allow a ray of solar light to enter a room, otherwise as well darkened as possible, through a small hole in a window-shutter. Let the end of the ray fall into a hat, suspended on the opposite side of the room. Then let the observer remark the effect of every fly, or minute particle of matter called dust, which passes through the ray. It will be difficult for him to conceive that the particles he sees are not eminently luminous in *their own* natures, such will be the refulgence of their appearance! Again, let him furnish himself with a bull's-eye lantern, and walk out into the open fields on a dark night. He will find the luminous rays quite invisible, except when they strike upon any object, such as a hedge, a tree, &c. In a stage-coach, if he sits with his back to the horses and to the lamps, which cast their light forwards, he will be entirely in the dark, except when the coach passes a wall or a hedge; and if he would wish to read or see the hour by his watch, he can only do so by the projection from the coach-box of a flap of a coat or a wisp of straw in front of the lamp, so as to *reflect* the light back to the place which he occupies. Many other trials might be suggested, but the hole in the window-shutter and the "bull's eye" lantern, properly used, will supply competent evidence of the extraordinary effects of *reflected* light. Any person standing on the top of a very high mountain, such as the cones of Etna or Vesuvius, and the heavens being cloudless and free from mist, if he turn his back to the sun, he will scarcely be able to see the hour by his watch, unless he so places his hand, or hat, or some other object before him, so as to *reflect* the light of the sun upon the object. A room, with its window towards the north, does not receive near so much light on a perfectly cloudless day as when there are many clouds floating along, which serve to reflect the light in all directions. During the most brilliant eruptions of Vesuvius, accompanied with a flow of lava at a perfectly white heat, I have been on the mountain, which has been suddenly enveloped in clouds. Upon this occurring, we find ourselves surrounded on all sides with an equal glare; and but for the knowledge of the ground, and the continued explosions, it would be impossible to distinguish from which side of us the light proceeds, intense and refulgent as it is, far more than the conflagration of the largest city in the world.

The principle of merely *reflected* light is sufficient for the phenomena of the *Moon*, and of Venus, Mars, Mercury, Vesta, Pallas, and Ceres. But with respect to the planets Jupiter, Saturn, and the Georgium Sidus, which are so much further removed from our and their sun, as to cause that paternal luminary to appear to them not much bigger than they appear to us, it is probable that, in virtue of their greater bulk, they possess a luminous property of their own, by reason of a cause which I shall perhaps be able to show in this communication, or in its sequel.

The objection I have made to Mr. Mackintosh's ideas on the *reflected* light of the moon and planets is scarcely worthy of being recorded; but as the subject may be very easily *enlightened* by the little *experiments* I propose, I have restated them for the benefit of those who may choose to try them.

With respect to Mr. Mackintosh's "electrical theory of the universe," I shall now proceed to state what have been my ideas on that subject ever since the year 1817. In that year I had the

good fortune to be thrown into a circle of acquaintance, amongst which were many men desirous of discovering the *truth*. They were pleased to listen to my "vagaries" and "singularities," as they were then pleased to call my opinions and convictions—with much indulgence and philosophical benignity and toleration. This was the more remarkable, as two of the interlocutors were beneficed clergymen of the Church of England—one named Stafford, of Groombridge, in Kent; and another, whose name I forget, of Tonbridge Wells. The other interlocutors in the discussions were, Mr. Bamfield, Mr. Powell, Mr. Jones, Mr. Woodgate, the banker (Newport), and two or three other gentlemen of distinction for intellect living in the neighbourhood. In order to condense and record the matter of my *lectures* (I may almost call them), I wrote a paper, which I have been looking for this month past without effect. The substance of it was as follows. The gentlemen above-named, who are, I believe, all living, will well remember it, and, I flatter myself, feel much pleasure in the reminiscence.

I shall begin by calling, what I look upon to be axioms, merely postulates. The brevity to which I am confined in such a communication, must be considered by the readers. However, I can return to the subject if you will allow me.

In the discussion of any subject of science, i. e. *facts*, it is necessary to dismiss and disregard the *opinions* and mere *dicta* of every authoritative and venerated name; only regarding the things which such men have *demonstrated* and *proved*. Secondly, we should care nothing at all about the *meta*physical doctrines which may arise from the *facts* produced. The great check to knowledge, is the constant endeavour of the schoolists to bend facts and theories to the *assigned* dimensions and limits of their *meta*physical dreams, instead of fitting the latter to the *facts* which should be their only guide and text! A French author (I think D'Alembert) very appositely compares the metaphysician to a well-digger, who "the deeper he goes, the more he is in the dark." Beware, all ye searchers after *truth*, of metaphysics! Look to physics and facts; study nature; record your observations; put them together; make a whole; see that it tallies with all surrounding and analogous things, and think for yourselves. Thus will *truth* at last prevail; and we shall arrive at the knowledge of the real causes which produce happiness or misery to the hitherto deluded and purblind occupants of the surface of this globe.

From the tenour of the communications you have received from several of your talented correspondents, I am sorry to say that their animadversions on Mr. Mackintosh's electrical theory of the universe, do not appear to be dictated by a pure and hearty desire to get at the truth. Objections and special pleadings against facts, or alleged facts, merely because the admission of them would militate against the received theories of Newton or Kepler, or any other name, however illustrious, forms a species of controversy more calculated to check inquiry and delay the discovery of truth than to promote it. The objectors, or rather sneerers at Mr. Mackintosh's theory, do not grapple with the subject as a whole, and, *ab ovo*, look at the foundation; but pick out a case or two, in which some other explanation under an authoritative name is asserted to furnish a *cause* for an effect, as clear and reasonable as the one deducible from the theory which they *à priori* feel disposed to combat. Whether Mr. Mackintosh's theory partakes of the ideas ("vagaries") of "*Wicked* Will Whiston" (for so his yearning after truth caused him to be called at the Universities), of those of Buffon, or of Dr. Burnet, has nothing to do with the investigation of *facts*. Our business is to examine into *facts*, so as to be satisfied whether they exist or not. If such *facts* are found as do not square with our theories or prejudices, the latter must give way "*Fiat justitia, ruat cœlum!*"

With regard to my own cogitations on the subject of cosmogony, I feel that I am entering on an arduous and invidious task in laying them before your readers. In order to develop the entire consequences, which naturally flow from the first positions, so as to form a consecutive WHOLE, would require several volumes; for the same laws which form, maintain, and reform the stars, suns, planets, and satellites, form, maintain, regulate, and reproduce every other body and identity belonging to the globe—primary formations, amongst which *man* on *this* globe occupies an important place; important,

at least, to himself, and inasmuch as his happiness or misery are concerned in the discovery of truth.

I do not well know what name to give to the positions I am about to propound. I cannot call them axioms, because, although *I* feel them to be such, they are far from being generally established as such in the minds of men. However, begin I must, and, for convenience sake, I will call (and think) them axioms, until some one will better inform me.

1st. Space is infinite. It is *impossible* for our imagination to form any idea of a limit to it. The entire of space with which we are acquainted, is occupied with certain intervals by the globular bodies we call stars, suns, planets, and I hope I shall be able to show that the entire infinite space *must* be, in like manner, so peopled with analogous bodies or globes. Thus, to use a happy expression of Pascal, every point of the universal space is the centre—there is circumference no where. "*Centre partout, circonférence nulle part.*"

2nd. This matter, which occupies a part of all space, must also have existed from all eternity. It is *impossible* for our imaginations to conceive any thing being produced out of nothing. "*Ex nihilo, nihil fit.*" Likewise, matter must be eternal in time to come, as it is equally impossible to conceive its annihilation.

3rd. A body, a thing, i. e. matter, must have a form or shape of some kind or other; and it must have properties and qualities inherent to it. Newton declares it to be an axiom, that no body can have any action or produce any effects upon any other body, without the intervention of some material agent communicating between the two.

4th. The universal property which we see in all matter, is motion; so much so, that we may declare that, "matter is motion, motion is matter." There can be no motion without matter; no matter without motion. I will not stop to prove the self-evidence of this proposition, but proceed.

The quantity of matter existing in the universe, is divided into two equal portions, one of which is *engaged* in the existing globes and other identities; the other half is in a state of transition, forming, increasing, condensing, renovating. But the sum total of the quantity must be always the same to an atom, in eternity past and eternity to come.

It is by *motion* that all bodies are aggregated or formed; and by motion that their parts are, sooner or later, separated to be formed again. At one period of the existence of a body, its motion, or rather that of its particles, tends to condense and maintain it—at another, the motion tends to expand and disperse it. At a certain period, these two forces acting one against the other, as will be stated by and by, preserve the body or identity in life and figure. All bodies are innately acted on by an effort or motion of expansion or perspiration from the interior outwards. Hence, if any body could be for a moment isolated beyond the influence of the surrounding bodies, it would instantly disappear and be dispersed in the regions of unoccupied space. But as all bodies emit and project their expansive emanations in all directions, and as *each globe is equally in the centre of the infinite number in infinite space*, all bodies receive the compressive force projected from the others upon every point of their surface, and are so preserved from dissipation. The consequence of this repressive force applied to the surface of all bodies, is, that that surface is more condensed than the interior parts, in which reside the expansive action. It is through the pores of the crust or skin of the suns, and stars, and planets that exudes the perspiration, and an analogous action is constantly proceeding through the skins of the human and of other animals. The matter transfused by all bodies is identical with their substance. That of the stars and of our sun, is light. The perspiration of the planets and of our globe, is also light, but only in the state we call caloric, which is not visible to our sight. The pores through which the expansive perspiration of a globe darts forth, are proportionate in size to the surface of that globe, and to the proportion which that surface bears to the spherical mass. The smaller the globe, the greater is its surface in proportion to its mass. The greater the mass, the greater will be the internal quantum of matter in expansive action, and the less in proportion will be the compressing power of the surface to retain it. Hence, the sun being more than a million of times the mass of the earth, each particle of the transpiration of the former must be a million times larger than a particle of the transpiration of the latter; and

being so, are visible and resplendid, and we see it and call it light. A lump of iron, only excited and expanded to a certain degree by the application of heat, emits its substance in the shape of caloric not visible to our eyes; but increase its expansive action, widen its pores, hurry the escape of its perspiration, the particles are enlarged, their velocity and succession multiplied, so as to be visible and denominated *light*. Hence, by analogy, it may be possible that the expansive perspiration of the larger planets, Jupiter and Saturn, shall in their particles be of such a size, as to be fairly visible to our optics. The particles of the substance of the stars and suns which are expelled through their envelopes by the internal expansive action, are themselves globes in a state of active vibration and expansive perspiration. As they proceed on their rapid way, they throw out particles of their own essence still more active and subtle than themselves. At length their course *must*, sooner or later, be arrested by meeting with other stars and planets, into which they penetrate. Thus each star and planet is compressed and penetrated and *fed* by the contributions of the whole, of which each globe is the centre. Hence all bodies, when in a soft or fluid state, are compelled to take the form of a sphere from equal pressure on every point.

All globes turn upon an axis. The reason of it I take to be, that no globe in its internal substance, or in its exterior crust, is of a perfectly homogeneous density and compactness. The radiating, expansive perspiration, from its incandescent internal mass, is liable, or was so at first, to issue in much greater quantity and energy along some particular line of its diameter than from the rest of its surface; so, on the principle of Hero's steam-engine, a rotary movement was produced. By reference to the map we shall see, that from the point of Terra del Fuego to the Frozen Ocean at the North Pole, one continuous line of volcanic mountains clearly indicate an easier issue to the products of the expansive action of the interior.* This movement of rotation once imparted, must necessarily occasion increased compression at the poles, and increased expansion at the revolving equator; and to this may be referred many of the phenomena of the magnetic-needle, the tides, and others, which, if I have time, I will allude to by-and-bye. The expansive radiation or perspiration of all globes proceeds from their most internal parts, as does the *insensible* perspiration of men and animals. The *sweat* in both globes and animals is given from the more exterior parts; the first is inherent and indispensable to existence—the latter, adventitious and inconstant.

The existence of all globes and animals is divided into two portions of action, exactly equal as to effect (barring accidents of lesion in animals). During the first period, the process of compression is constantly on the increase; from a fluid state the parts, especially the outer, become more and more condensed, maugre the expansive effort of the interior. Arrived at the middle period, the forces so justly counterbalance one another, as to constitute the epoch of the greatest health and vigour. Partial eruptions have taken place, indicative of the energy of the central powers, but they have been constrained by the circumventing action of the repressive forces. During the youth of all bodies the predominance of *compression* obliges the body to grow, by *confining* the matter projected outwards by the power of expansion. But expansion, at last, gets the victory; and so soon as it is communicated to the outer envelopes, dissolution and separation takes place. During the second period the internal cavities enlarge; the external envelopes, integuments, muscles, and skin, become more and more flaccid, weak, and unelastic. The central expansive emanations—the heat—is dissipated faster than it is generated. A stone thrown up in the air arrives, at last, to a stationary point; it then descends with increasing swiftness until it returns to the ground. So is life—the life of all identities—globes, large and small, suns, stars, planets, men, and vegetables!

If the two forces of compression and expansion exactly balanced each other, *immobility* would ensue, which is not *life*. But one of those forces predominates during the first period—the other during the second, to the end of the chapter.

* Iron, or silver, or copper, or any metal that requires a great heat to melt, being in a fluid state in active radiation, and in no greater quantity than will form a small globe or "button" at the bottom of a crucible, being removed from the fire, will be seen to be rapidly turning round like a top.

The phenomena attending the formation of steel will furnish us with a type of this fact of repressed expansion. We set the particles of a piece of iron in a state of violent activity, and introduce into its substance an expansive action of an intense condition; in that state of things we plunge it into cold water, by which the expansive activity is thrown inwards, and a crust or skin of extraordinary hardness is formed around it. But let that crust or skin be injured by rust or by the cutting of a diamond, &c., or its pores opened by a second application of heat, that surface can no longer repress the extra internal expansion, and elasticity is destroyed. Melted glass dropped into cold water forms long, pear-like bodies, with a thin neck. Great part of the violent radiation which was proceeding from it, when incandescent, is confined with it by the sudden compression of the cold water. Break off a bit of the neck or stalk, you supply an issue, which being too small for the sudden rush of the imprisoned expansive action or electricity, which is excited by the rupture, the mass is shivered into a thousand pieces. Expose one of these drops of glass to heat, and it loses its explosive quality. The expansion has escaped quietly through the dilated pores of the entire surface.

I will go on by endeavouring to show, that as there is only one law in nature, so is there only one substance. By "one substance" I mean, that all bodies, of whatever appearance to our senses—solids, fluids, gases, the sun, earth, stars, and planets, flesh, fish, and fowl—are all identically of a similar substance, and that that substance is identical with the substance of the sun. This substance, in some of its phases, or modes of being, is what we call light, caloric, galvanism, electricity, and magnetism.

All bodies transpire; and all bodies, not in a state of destructive separation, have an internal current or circulation of the particles identical with their essences, and with the essence of the transpiration of the globe, which again proceeds, like our insensible perspiration, from the most internal and active portions of its composition. The transpiration of solid bodies is only in a slight degree perceivable to our senses; but brass, copper, tin, and some others, betray a part of their dissipation to our organs of smell. A bar of iron is of a conformation, in which it appears, that the evasion of the products of its internal expansion find a more ready issue at the two extremities, which we call *poles*. This disposition and distribution in bodies which are susceptible of it, from their nature and from their shape, is called alimentation. The currents are so disposed in a bar of iron, because the compressive influence of the stars, and of the surface of the bar, gives much greater facility for the exit by the two ends than through the extended surface. Moreover, this condition of expansion, which we call magnetic, in order to be exhibited in the most conspicuous manner, the bar of iron employed must be maintained for some time in a constant position. All fluids are disposed to flow spontaneously through tubes of small dimensions. Of this (capillary attraction) we will speak anon; and a bar of iron, with respect to the expansive emanations of the globe and its own (the galvanic) presents, as it were, a bundle of parallel tubes for the action of the fluid. We will suppose a bar of iron inserted vertically in the earth; this latter portion will be more dilated than that which is more exposed to the still or compressive impulsions. The major pole is that in contact with the earth; the minor is at the upper extremity. If this bar be reversed, or its position changed, the projecting currents, which we will call the equilibrium of *separation*, are changed into the equilibrium of *mixture*. The course becomes confused, and the magnetic property temporarily lost. If you present the minor pole of a magnetic bar to the minor pole of another bar, the equilibrium of separation is promoted and confirmed; but if the two major or the two minor poles are brought into contact, their products are driven back into the interior, and the bars are repulsed one from the other.

I have not time or space to enter more than skin-deep into this important subject at the present moment; but I must go on to show the gist of my communication, which I cannot do without trespassing still further on your valuable space. Indeed, for the sake of brevity, I have almost broken the thread of my ideas, by omitting the connecting links of my exposition. Steel is much better suited for the formation of magnets than iron, because it *retains* the fluid better. Iron

being softer, and of easier *perforation*, receives the fluid and gives it out faster than steel. Hence the "arming" of soft iron applied to steel magnets. This globe is a vast magnet; the two poles being two real magnetic poles, the one *major*, the other *minor*. The major pole was caused by the circumstance, that in the course of the year there are about eight days more sunshine on the north than on the south pole. The north is the major pole, the south is the minor. The north produces iron, and strong, vigorous men and animals: the south, gold, and less vigorous identities; besides, that the climate of the south is, at equal latitudes, much colder than the north. The actual *caps*, if so I may call them, of the two poles of the earth being extremely condensed, the currents of magnetic fluid which flow towards them are disposed to make their exit, and diverge more or less as they find the crust of the earth more easy of penetration. Therefore have we the *declination* of the compass. The magnetic current does not follow exactly the axis of the globe, but, for the foregoing reasons, makes its exit somewhere near, but not exactly *at* the poles. In like manner, the point of greatest activity in steel magnets of a certain shape is not exactly at the ends of the bars, but at a point very near and around them.

All solid bodies, whether animal, vegetable, or mineral, being reduced to a size and shape of sufficient tenuity and lightness, and suspended by means of a delicate filament, will spontaneously assume the direction of the magnetic meridian; provided that they be in a state of health, that is, not of destructive or putrescent decomposition. This is *one* of the proofs that all bodies are in a state of intestine expansion; and that the elements of all bodies are the same, as they sympathise with the same homogeneous fluid current.

In my next letter, I shall make some remarks upon the action of galvanism.

F. MACERONI.

CULTURE OF SILK IN ITALY, FRANCE, &c.

(Extracts from Letters from General Tallmadge to the American Institute.)

"*Naples, 5th March*, 1836.—Since I arrived in this land of fame and fable, I have not been unmindful of the culture of silk, so justly a subject of great and growing interest to our country. I have visited several manufactories of silk. It is not the season for seeing the silkworm, but most of its progress in other respects I have been able to see. I have made many inquiries in hopes of obtaining useful information. Finizio is an extensive manufacturer of sewing-silk; he makes about 30001bs. a-week, which is most sent to the New York market. He is an intelligent man, and I found him willing to answer my inquiries; as also were several other establishments, and which mostly confirmed his statement. The sewing-silks of Naples are mostly made from the silk grown in *Calabria*, where the worm is fed principally upon the *black* mulberry, and which makes the strongest and best for sewing-silk. Finizio stated that the worm fed on the black mulberry made the strongest thread; *that* on the *white* mulberry, finer and better for fabrics; *that* on the Chinese mulberry still finer and more delicate. When asked if the cocoon from the Chinese mulberry required more skilful and delicate work to wind and work it, he said it did, and immediately produced two skeins, one of which he said was from the black mulberry (from a bush, perhaps, eight or ten feet in circumference), the other from a bush about four feet. The lesser bush, he said, was less liable to break the thread in winding from the cocoon, and was used in finer silks for fabrics. The black mulberry produced a stronger thread, and would bear the larger reel, and was principally used in that business. The silk here is mostly made in the country by families in detail, and much of it reeled there, and in this condition it is brought to market. For sewing-silk it is doubled as often as required, and twisted as much. This process is wholly in a *dark room*. The silk is worked wet, and for this purpose, to preserve a uniformity, the atmosphere is kept damp, the daylight excluded, and the work carried on with small hand lamps. The machine was turned by men harnessed like mules. I have since been out about twenty miles to the silk factory of the king, which is worked by water power, and by which the cocoons are also reeled. I stated to Finizio, as well as at the king's factory, that the Italian sewing-silk was sold in the American markets by its weight, while the American sewing-silk was sold by the skein; and that one pound of the Italian would have perhaps two hundred and fifty skeins, while one of the American silk would have about three hundred and fifty skeins. The cause of this difference of weight, or why the American sewing-silk has a tendency to curl or knot, they could not explain without a sample, but said the weight of sewing-silk could be diminished or very considerably augmented in the *dyeing*, and that good dyeing required the silk to be well *boiled*

in *soap*, after which it was put into an acid, and was there prepared for the process of the dye, according to the colour, as desired. The gloss, or dressing, seems to be produced by beating and twisting on a post, which, with the manual labour put upon its finish, it is supposed prevents its tendency to knot.

"I asked if the colour of the cocoon, yellow or white, gave any difference of value, or indicated a sickly worm, and the answer was that the colour was casual, and the value the same; that a selection of white or yellow cocoons from which to get eggs would probably produce a like colour; and Mr. Finisb said he had some customers who had so selected and brought him *cocoons* entirely *white*; and that for the white ribbons or fabrics, they commanded a greater price of from three to five per cent., though otherwise of equal value.

"I have made many other inquiries and observations on this subject, but which in the limits of a letter cannot be detailed. The eggs are here in market during most of the year, and by being kept in a *grotto*, or cold damp place, the worm can be produced as required. The sirocco, or hot south wind, is here the greatest enemy of the silkworm, and sometimes suddenly destroys so many of the worms as to require the reproduction of another class from eggs in reserve. They should be sheltered from this wind, and ventilation should be given them from above or by back windows. I think we have sometimes a like south, or south-west wind, which should be guarded against, and which our gardeners call a *red wind*, from a rust produced by it on peach and apricot trees, which curls up and burns the young leaves, and often kills the trees, and is said to affect the mulberry trees in like manner.

"*Paris, April 6th*, 1836.—In my last letter from Naples I believe I promised to say something more on the cultivation of silk. I have since travelled through Italy, and especially in the silk districts, and also through France, and have visited many of the manufactories in both countries, endeavouring to learn the details of this subject, now so interesting, and, I think, so essential to our country. The limits of a letter will, however, confine me to a few isolated remarks.

"The weaving of silk after it gets into skeins, is like any other weaving of like character; it is the production of silk, and the habit of growing it, that must be acquired by our country; and it is in this view, a mine of boundless wealth, not second even to the production of cotton. The country which so lately surprised Europe by sending *eight* bales of cotton to its market, and now astonishes the world with its countless thousands, may soon exhibit a like wonder in the production of its silk.

"In Calabria, which is in the south of Italy, the black mulberry is principally used. In the rest of Italy the white mulberry, common to them and to France, is principally used. The north of Italy, that is between the Alps and the Appenines, produces the most and the best silk. In this region, and especially in Sardinia, near Turin, and at *Novi*, the English and French are competitors in market, to purchase their silk as the best in the world; and yet on the 9th of March, the snow was one foot and a half deep, and the streets of Novi blocked up like our Cedar-street! In Calabria the silk is produced by the country people, in their families, and mostly reeled by them. There are very few factories for reeling in the Neapolitan kingdom. In Lombardy, and towards Venice, there are also establishments for reeling, yet the greater part is reeled by the families, in detail, and brought to market in the skein. In Sardinia the cocoons are mostly reeled in establishments. At Novi their reeling establishments are numerous:—I saw one, now erecting, which is a quadrangle *two hundred* feet square, and appropriated solely to reeling cocoons. They are purchased up from near Milan, and many miles distant. This is admitted to be the best silk in the world. The *red* mulberry is here principally used, and is known as the Calabria mulberry. It is described as having a dark fruit; the tree is like our *black*; and when I called it *black* mulberry, I was corrected, and told the *stalk of the fruit* was *red*, and not *black*, and which gave the character of the tree. The French, in addition to the *white* mulberry, have a *dwarf* white, much liked, and getting into use; but, it must be remembered, there is not in France, and scarcely in Italy, a fence, and they do not graze their fields as we do. With our habit of pasturage, the dwarf would be inadmissible. The *Chinese* mulberry is unknown in Italy. I found only a few young engrafted trees, but no experiments there, to be relied upon, to establish its superior utility. In Italy and in France, the mulberry is generally planted near the houses, along the road sides, by division fences, and often like an open orchard. The trees are formed like a middle-sized apple tree. Its shade does not injure the land. The tree in Italy is usually made to sustain a grape vine, and the field is cultivated for wheat and other crops. There is less discrimination here than you would imagine in the kind of mulberry. The French have made experiments, especially on the Chinese; and the opinion seems to be, that the Chinese mulberry will bear to have its leaves twice picked off, and thus produce two crops of silk in one year. As yet, however, there is not much use made of the Chinese mulberry, even here, and the grower of silk cannot

answer as to its virtues;—but the answer is often given to me, that, as to the *quality* and the *quantity* of the silk, it is the *same* as any other mulberry; and that the quality of the silk depends on the treatment of the worm, and the care and skill in reeling. They pay less attention to the *kind* of mulberry on which it is fed than we expect. They have also *white* and use it. *Habit* directs more in Europe than with us, and therefore I urge that our people make experiments for themselves. They should neither take nor reject any thing too quickly upon European experience. Climate and circumstances may produce a different result, and the alleged experiments of Europe may have been incorrectly or inadequately tried.

"*Paris, April* 12*th*, 1836.—In my last letter, when speaking of the planting and culture of the mulberry tree, I fear I omitted to add that proprietors of land often cultivate the mulberry tree with a view to profit from the leaves. It is common in France and Italy, to sell the leaves to families, who rear the worms, at a fixed rate; but it is more usual for indigent families to plant a certain number of trees. They furnish the leaves, feed, and take care of the worms, and return to the owner of the land one equal half of the cocoons produced, which is his share of the income, and a most convenient one it is, to be produced from the trees along the road side, and in places which do not injure his agriculture; and this kind of tenating is of immense benefit to the industrious poor.

"The French are, like all Europeans, slow in acquiring new habits, or making any changes in their pursuits. From this cause in practice, the different mulberries are not heeded. They have white, from habit, and do not yet use the Chinese mulberry. We have more of the Chinese growing than France and Italy together."

FIRST REPORT OF THE DIRECTORS OF THE EASTERN COUNTIES RAILWAY.

(Read on the First General Meeting held at the London Tavern, 28th September, 1836.)

The Act for the incorporation of this Company received the Royal Assent on the 4th of July last, and by one of its provisions, the first General Meeting of the shareholders is appointed to be held within *six* months after the passing of the Act; but the directors,—feeling persuaded that the sooner they could make officially known to the proprietary and the public the actual state and prospects of the undertaking, the sooner it would attain that high place which it is entitled to hold in public estimation,—have called this meeting within less than *three* months from the date of the Act; on the earliest day, in fact, which the time unavoidably occupied in organising the establishment of the Company, and in auditing the expenses incurred in its formation, could possibly allow.

Nearly three years have now elapsed since the design of the Eastern Counties Railway was first given to the public, and several preliminary surveys made; but it is not more than ten months since it can be said to have taken any considerable hold on the public mind. The month of October last was far advanced before a Provisional Committee of sufficient weight was formed for the prosecution of the undertaking, and there then remained but six weeks within which to make all the necessary preparations previous to going to Parliament in the ensuing session. Within this brief space, the whole line of a hundred and twenty-six miles, the longest that is yet in progress in any part of the kingdom, had to be surveyed, and the maps and sections, required by the forms of Parliament, prepared: the whole of the owners and occupiers too, for a breadth of half a mile, had to be canvassed for their assents, that extreme breadth being taken in order to allow ample scope for such alterations as circumstances might afterwards render expedient. Even when the requisite plans, sections, and books of reference, had by extraordinary exertions on the part of the engineers and their assistants,—exertions which the Directors honestly believe to be without a parallel in the history of such undertakings—been deposited in due time, there yet remained much to be done in order to obtain for the undertaking an adequate share of public confidence. Early in November, the chairman and two other members of the Provisional Committee had made a progress through Essex, Suffolk, and Norfolk, for the purpose of personally representing to the leading gentlemen of these counties the claims which the undertaking had to their countenance and support; and also of calling public meetings of the inhabitants to investigate and decide on its merits: and the demonstrations of local approbation which this deputation were the means of eliciting, were so numerous and decisive, as to leave the Committee in no doubt that they had the hearty concurrence of the counties in their endeavours to carry out the plan to a successful conclusion. But though the good-will of the counties had certainly been conciliated, the confidence of the monied interests of the country, from whom alone could be expected the bulk of the large capital required for its execution (the largest subscribed during the past year for any railway project), had still to be gained. The various steps taken to this end, the Directors need not stop to detail: it may suffice to state that, by the choice of active and judicious agents, and

without having recourse to any adventitious aids to stimulate the spirit of adventure—by simply making known, far and wide, the sterling merits of the undertaking — the greater part of the capital was subscribed before the second reading of the Bill. In point of *numbers*, the shareholders residing in, or connected with, the counties themselves, bore a fair proportion to those having no local interest in the line; but the amount of capital subscribed for by them was little more than one-twelfth of the whole. Without the powerful assistance, therefore, derived from other and distant parts—from Manchester, Birmingham, Bristol, Bath, Edinburgh, Glasgow, Dublin, and, above all, from Liverpool, the opulent and intelligent citizens of which, ever foremost in the encouragement of great enterprises, at once subscribed for upwards of 12,000 shares of the Company's stock;—it may with perfect truth be said, that the undertaking must have fallen (for the present at least) to the ground.

Notwithstanding the success which had so far crowned their exertions, the Directors were still but in the midst of their difficulties. A parliamentary opposition had yet to be encountered—an opposition, as it happened, of a more than usually obstinate character. There were two rival lines in the field, both of more recent suggestion than the Eastern Counties Railway, neither of them well suited to the wants of these counties, but both, nevertheless, very respectably supported. There was also a formidable array of dissenting owners and occupiers, headed by gentlemen of great parliamentary influence, and to all appearance irreconcileably opposed to the undertaking.

It was under these circumstances, with no ordinary anxiety, that the Directors proceeded before Parliament, and by no ordinary exertions that they were enabled to maintain their ground there, against the serious opposition with which they were met. The second reading of the Bill in the House of Commons was not carried without a division; and in the Committee, to which it was referred, were several of the most active members of that minority who voted for throwing it out. So strong, however, was the case proved in evidence for the Bill, and in so conciliatory a spirit were the opposing parties met and arranged with out of doors, that in a short time all opposition was at an end, and the Committee unanimously agreed to a report to the House in favour of the measure, which concludes in the following highly recommendatory terms:—

"Your Committee think it right to add that, according to the evidence adduced, the Eastern Counties Railway, between the termini, would traverse the most populous and most cultivated parts of the counties through which it is intended to be carried, and that great benefit would be given to trade and agriculture by its adoption."

After the Bill had passed the Commons, several new and powerful opponents sprung up; but the Directors, by meeting the parties with the same promptness, and in the same fair spirit, which had carried them successfully through their previous negotiations, effected amicable arrangements with them also, and the Bill was finally passed by the House of Lords, as one, which was now on all hands allowed to have for its object, the accomplishment of a measure of great public utility.

The Directors, in giving this brief history of the undertaking, would have been disposed to dwell less on the difficulties they have had to encounter and have overcome, could they by a more reserved course have equally well justified to their constituency the price at which success has been purchased.

The shareholders will see, in the expedition with which the Parliamentary plans, sections, and books of reference were executed —in the more than usual breadth of country which was surveyed—in the great number of persons that it was requisite to employ for that purpose, at a time when hands for employment of this description were scarce, and their terms of remuneration proportionally high—in the numerous agencies which had to be put in motion in order to raise so large an amount of capital—in the many opponents who had to be negotiated and arranged with —and in the very short period within which nearly the whole of these things were transacted;—the shareholders will see in all this, reasons sufficient for anticipating a much larger amount of expenditure than would, under less extraordinary circumstances, have certainly sufficed.

As it is, however, the Directors believe that, compared with other railway contests, this will not be found to have been more costly than usual; and, instead of having occasion to bespeak your patience for an exhausted exchequer, they are happy to announce that, large as their expenditure has been, they have still in hand a large and unencumbered balance.

From the balance-sheet annexed it will be seen that the total receipts of the Company up to the present date amount to 61,845*l.* 2*s.* 9*d.* The claims brought against the Company have, by careful revision of these claims, and allowances conceded for prompt payment, been reduced by 2383*l.*; making the net amount of the expenditure, 36,561*l.* 19*s.* 2*d.*; deducting which from the monies received (61,845*l.* 2*s.* 9*d.*), the balance remaining in hand is 25,815*l.* 2*s.* 9*d.*

When the Directors look to the magnitude of the object, which the sum thus expended

has been the means of achieving, they think they may fairly congratulate the shareholders upon the general result. In a single session, with no more delay than the forms of Parliament rendered unavoidable, this Company has obtained its Act of Incorporation;—that for which other proprietaries have had to struggle through several sessions, and to pay twice and thrice as much;—an Act of Incorporation, too, which secures to them the perpetual proprietorship of one of the best lines of railway in the whole kingdom, with all the great profits legitimately derivable therefrom.

The Eastern Counties is not only the longest integral line of railway which has yet obtained the sanction of Parliament, but traverses a larger extent of cultivated and highly productive country than any other; those districts from which the immense population of the metropolis derives its chief supplies of agricultural and marine produce.

From the peninsular character, too, of this portion of England, washed as it is on three sides by the German Ocean and the Thames, it is obvious, that a main-trunk line, which follows, as this does, the ancient and long-established course of traffic, and touches at nearly all the places of greatest business, must draw *and keep to itself* the great bulk of the carrying trade of the district. Other railways may be interfered with, but this never can. As a great main line, it must always stand alone—dividing with no other railway, though receiving the tributary contributions of many.

Another novel and important feature of the Eastern Counties line is, that, notwithstanding its great length, *there will not, from beginning to end, be a single tunnel.*

If at one or two points it goes wider of considerable towns than could be wished, this has arisen from no indifference to the wants of those places, but from the necessity of consulting the general interests of the whole line, and of the majority of those who are to use it, in preference to all minor considerations.

The Eastern Counties Railway will have completely fulfilled the purpose for which it was designed, if it serve as the great trunk line of this part of the kingdom, from which branches may radiate into as many of the outlaying districts on both sides, as possess traffic enough to pay for this superior means of communication.

Already not less than six railways, branching from the Eastern Counties line, have been projected with apparently fair prospects of success; all of which, when executed, must contribute more or less to swell the profits of this Company, without involving the necessity of any addition whatever to its capital.

The Directors desire particularly to call attention to the *Thames Haven Railway*, for which an Act of Parliament was obtained in the last session of Parliament, and which is to branch off from the Eastern Counties at Romford. The capabilities of this line are undeniably great. Were it to do no more than introduce into the heart of Essex a more abundant supply of coal, it would confer an incalculable advantage on that county, and pay the adventurers well; but should it also become, as its projectors confidently anticipate, the great channel for the conveyance of an article of such universal consumption as coal to the metropolis, it would be difficult to assign a limit to its value in a financial point of view. The point chosen for its seaward termination offers also such facilities as a steam-packet station, that there seems strong reason to hope for a large accession of passenger-traffic to both railways from this source.

Next in local order, follow the *Maldon Witham and Braintree*, the *Harwich*, the *Ipswich and Bury*, the *Beccles Bungay and Harleston*, and the *Norwich and Leicester*, branches, which embrace among them nearly all the principal towns of the three counties, which were necessarily left at a distance in the setting out of the main trunk line, but will be now brought by these branches into immediate and productive connexion with it.

To these branches there is yet another to be added, which, though not projected with a view to the wants of any part of the districts immediately intersected by the Eastern Counties Railway, will in all probability prove one of its most valuable tributaries. The Directors allude to the recently projected line of railway from London to Rochester and Chatham, *through Essex*; the communication between the opposite sides of the Thames being effected by a short steam-ferry at Tilbury and Gravesend. By taking advantage of the Eastern Counties and Thames Haven lines for about seventeen miles of the entire distance, this railway will be executed for one-fifth of the cost of any line that can be executed *along the Kentish side of the river*. Although this line takes what may at first sight seem a circuitous course, it will, in fact, be little longer than a straight line between the two termini, and exceed by one mile only the distance by the present high road. The number of passengers to and from those parts of Kent, to which this railway will present the shortest possible communication with the metropolis, exceeds at present one million; and assuming that one-fourth only of this immense passenger-traffic will fall to the share of this railway, this will add 25,000*l.* per annum to the revenue of the Eastern Counties Railway, from a source never thought of, or taken into account in the original calculations of its promoters.

According to the estimates, which were produced in evidence before the Committee of

the House of Commons, and reported by that Committee to be verified to their satisfaction, the traffic of the Eastern Counties Railway will yield a return of 22 per cent. on the capital required for its formation. The Directors have since tested this result in a variety of ways; but so far from seeing any reason to doubt its accuracy, they incline to think that the real facts of the case would have fully justified even a higher estimate.

No credit whatever was taken in the Eastern Counties Railway estimates for any of the passenger-traffic from *transmarine* sources, as that traffic was, at best, of a contingent character. But, unless the Directors are greatly mistaken, the traffic from these sources alone will suffice to pay the entire expense of working the line, leaving all the revenue derivable from the home traffic to count as so much clear gain.

The counties of Essex, Suffolk, and Norfolk, stand in such a geographical position as regards the northern continent of Europe, and the eastern coast of Scotland, as to offer the nearest route *by railway* from all these parts to the British metropolis. Steam vessels from any continental port north of the Texel, or from any port on the east of Scotland, by putting into Yarmouth, which they can now do with the greatest facility at all times of the tide, and landing their passengers there, will enable them to reach London by the Eastern Counties Railway, from fifteen to twenty-four hours sooner than they can now do by water, and, on occasions of contrary weather, even two days sooner. To the steam-packets again, from the more southern ports of Rotterdam, Antwerp, Ostend, and Dunkirk, the port of Harwich will present an equally accessible harbour, from which the passengers may, with a proportionate saving of time, proceed to London by the Harwich branch of the Eastern Counties line. Yarmouth and Harwich were, it is well known, formerly the principal packet-stations on the Eastern coast of England, but lost that traffic through the introduction of steam-navigation. It was then found, that by despatching the Hamburgh and other north of Europe mails by steam-vessels direct from the Thames, even though these vessels should not leave the river for eight or nine hours after the mails were made up, the land journey to the outports was saved, and the mails conveyed to their destination in less time, and with more certainty than could be done by steam-vessels from any other point of the coast. But as soon as a railway communication is established with Harwich and Yarmouth, all this advantage will be lost to the Thames. The damage which steam has done to these ports as packet-stations, the same mighty power will yet be the means of amply repairing. By sending off the mails by the railway to Harwich and Yarmouth as soon as made up, which is not later than twelve o'clock at night, they will reach these ports by the same hour of the morning at which they now leave the Thames; one half the voyage will be saved; and an entire day, and often much more, gained in the course of transit. And thus, in the same way that the modern steam-vessels supplanted the old sailing-packets, may we surely reckon on seeing the steam-carriages of the Eastern Counties Railway restoring to its former course the passenger-traffic and commercial correspondence, between the British metropolis and the whole of the north of Europe.

The Directors beg, in conclusion, to assure the shareholders that the same spirit of determination which has enabled them to overcome the numerous difficulties which stood in the way of their obtaining the Act for the Incorporation of the Company, will continue in full vigour till every obstacle to the execution of the trust reposed in them has been overcome. Immediately on the Act being obtained, they directed all the necessary measures to be taken for enabling the engineer to commence operations with the least possible delay at both ends of the line, in order that the two portions of it likely to be the most productive,—namely, the London and Romford, and the Norwich and Yarmouth,—might be the soonest completed and opened; and negotiations for the purchase of the houses and lands required, are already in an advanced state. The expenditure on these parts of the line will be heavier than on any other; but in consequence of the considerable balance of the deposits left in hand, it has not been found necessary to make in the first instance a larger call than 1*l.* per share; and as the Directors have no doubt that this call will be responded to with cordial unanimity, the works will be in full progress before any further call is made on the shareholders.

Since the Act was passed, two vacancies have occurred in the list of gentlemen therein nominated, to constitute for a limited time the first Board of Directors; one by the lamented death of Mr. Crawford, and the other, by the resignation of Mr. Tite, who has since, with much advantage to the interests of the Company, been appointed its surveyor. The Liverpool shareholders, who now hold one-third of the entire stock of the Company, having at a late public meeting expressed a strong desire that they should be represented in the Board by two or more of their number, the Directors, considering this desire to be no more than just and reasonable, have, in virtue of the powers given them by the Act, elected two of the largest shareholders in Liverpool,—namely, Lawrence Heyworth, Esq., and Richard Hall, Esq.,—to succeed Mr. Crawford and Mr. Tite. In thus obeying the voice of the large and respectable portion of their constituency who

are resident in Liverpool, the Directors are happy to state that they have at the same time added to their body, two gentlemen whose assiduous habits of business and intimate acquaintance with railway matters, are like to render their accession to the direction of the greatest advantage to the interests of the Company.

It may be proper to add, that by the Act of Parliament a certain fee is authorised to be taken on each certificate of registry and each transfer of shares; but that the Directors, considering that the levying of such a fee would impose an unnecessary tax on the shareholders—in the first stages, particularly, of the undertaking—have ordered that it shall not be enforced.

Signed, on behalf of the Directors,
HENRY BOSANQUET, Chairman,
R. J. HARVEY, Deputy Chairman.

30, Austin Friars, Sept. 26, 1836.

CORNISH STEAM-ENGINE WORK.

Sir,—The object of my former letter has been attained by Mr. Dickson's expression—that I have taken upon *myself* to be the champion of the Cornish engineers; and also by his corrected restatement of my assertions. With regard to comparative calculations of steam-engine work, it appears to me, that since either, 1st, the weight moved—2d, the height or distance—or, 3d, the quantity of coal used—may be made the varying quantity (railway locomotives adopting the last, and pumping-engines the first method), the suggested change is without a definite object. The argument relative to rain-water is good; and the strictest examination into Mr. John Taylor's data is desirable, to ascertain whether he has sufficiently allowed in his calculations, not only for this point, but for the different circumstances attendant on the working of the mines adjoining Dolcoath and Consols. This argument would have had more force if the probable effect of the extension of levels had been accounted for, and not omitted. The observation relative to the depth from which water is drawn in some mines seems to me to be a sufficient answer to the sentence which follows, and confirms, moreover, my assertion of the difficulty of ascertaining the exact delivery of water from eight or nine lifts, many cisterns receiving part of their water from the lift below and part from the adjoining levels.

Since the public are said to take an interest in this subject, I will address a few words to such of them as are employers of steam-engines, as I fear an expression in my previous letter might tend to countenance an erroneous opinion of the control of the engineers over the report of "work performed by steam-engines in Cornwall," should its existence be known to them. The *duty*, as calculated from the number of strokes registered by the *counter* first used by Watt as a check on the mining adventurers or proprietors, has been since 1812 used by the latter as a check on their engineers; and I conceive the real question to be, not whether such check is quite exact, or not, but whether it is a proportional test of a steam-engine and its pumps; whether it is as fair in the present as in the last century. As such it was adopted by the mining adventurers; and its variation in every monthly statement, from twenty to ninety millions in different engines, is rather an argument of "Fair Play, and no Favour." With regard to ascertaining the difference between the actual and calculated delivery of water, it is necessary to lengthen the pump or rising main the height of the required cistern; and this must also be done at each cistern which receives water from the levels adjoining. Perhaps one of the larger mines might undertake the necessary trouble and expense for the satisfaction of known parties of eminence; but certainly not to satisfy idle curiosity, and most assuredly not to answer a protest, whose tone has a tendency to defeat its professed object.

Whenever a protest appears supported by calculations pointing out the mode in which the asserted errors have found their way into the stated amount of the present duty of good engines—particularly if the mines have been examined by its author—I feel no doubt it will meet with due attention. The private premiums awarded through the medium of the Polytechnic Society in the present and preceding year, are perhaps the strongest protests yet made relative to this point. As an individual, I have constantly proposed to deduct from Watt's duty a quantity proportional to the difference, when proved, between the actual and calculated delivery of water—first making the allowance of the difference of the Imperial bushel of 94lbs. of Welsh coal as compared with the Winchester of 89lbs., Newcastle or engineer's coal being about 88 to 81lbs. The only published account, I believe, of any monthly duty of Watt's engines

during the patent is in the *Philosophical Transactions* for 1830, which contains also the document on which Watt's agreement relative to the savings of coal was founded. I have always observed that the objectors to that agreement forget that the delivery of the water by the trial pumps was proportionally deficient. Should any person be unwilling to agree to this compromise, I then claim a superiority of the present delivery of water greater than the difference of the bushel of coal, and call for proof of a greater monthly duty than twenty-nine millions during Watt's patent.—Yours, &c.

JOHN S. ENYS.

Enys, Sept. 25, 1836.

MR. MACKINTOSH'S SECOND LECTURE ON HIS THEORY OF THE UNIVERSE.

This lecture (delivered on the 10th inst.) related to the *laws* and sources of motion. Mr. Mackintosh commenced his observations by referring to Newton's first law of motion, that "if a body be at rest, it will continue at rest; and if in motion, it will continue to move uniformly forward in a right line, *if it be not disturbed by the action of some external cause.*" Upon this law the whole Newtonian system was founded, and the law, he remarked, would be true, *provided all the conditions were fulfilled.* To satisfy those conditions, he observed, we must suppose space to be void of all matter, except the said moving body, which supposition would be opposed to our knowledge, that space is filled with innumerable bodies which, by their mutual attractions, act and re-act on each other. No body, he said, could pass through the solar or any other similar system without being subject to the disturbing action of external causes, therefore the whole Newtonian system was founded upon an imaginary axiom which had no existence in nature. He next proceeded to observe, that the Newtonian system recognised only one proper force, gravity, under the action of which all bodies tend to a centre; he contended that momentum, or a centrifugal *force* (as it was called), was no *force*, but merely an *effect* derived from a force; and might be destroyed by force; that therefore the Newtonian system recognised only *one real force*, gravity; that the momentum, supposed to be derived from an original impulse, was continually diminished by the force of gravity, and therefore, if the motions and distances of the planets were determined by gravity and momentum alone, they must all have merged in the sun thousands of years ago. The great fallacy of the Newtonian system consisted, he remarked, in considering momentum as a real force.

He next proceeded to show, that all motion whatever might be traced to the expansion and contraction of matter under the directing will of the Deity, and laid down the following axioms to illustrate and support that proposition.

1st. The expansion of matter results from its decomposition by chemical action; and may, therefore, be called chemical motion, or the repulsion of particles.

2d. The contraction of matter, resulting from the action of gravity, may be called mechanical motion, or the attraction of particles.

3d. All chemical motion resulting from the decomposition of matter tends from a centre to a circumference; at any distance from that centre, the distance to which the motion proceeds from the centre, being greater or less, as the intensity of action or quantity of matter is greater or less.

4th. All mechanical motion resulting from gravity tends from a circumference to a centre, the time which the motion continues being greater or less as the velocity or distance from the centre is greater or less.

5th. If chemical motion continually tends from the centre to the circumference, a perpetual chemical motion is impossible, because whatever may be the dimensions of the mass, it must have a centre, at which point chemical action would cease.

6. If mechanical motion continually tends to a centre, a perpetual mechanical motion is impossible, because whatever may be the dimensions of a circle, it must have a centre, at which point mechanical motion would cease.

7th. But a perpetual motion may, and does exist, and is a necessary result of the two forces, viz. of chemical motion tending *from* a centre, and of mechanical motion tending *to* a centre, and these two forces may, and will continue to produce motion for ever.

He next proceeded to show that all motion was produced by these two forces; that the sources of rivers were supplied by rains—which receded from the earth in an expanded form, and returned again to the earth in a condensed or contracted form; that the motion of the atmosphere was produced by the same forces; the motion of the steam-engine, and even animal motion, which is dependant upon the pulsations of the heart, he traced to the expansion and contraction of matter, applying the same principles, in an extended sense, to the whole universe.

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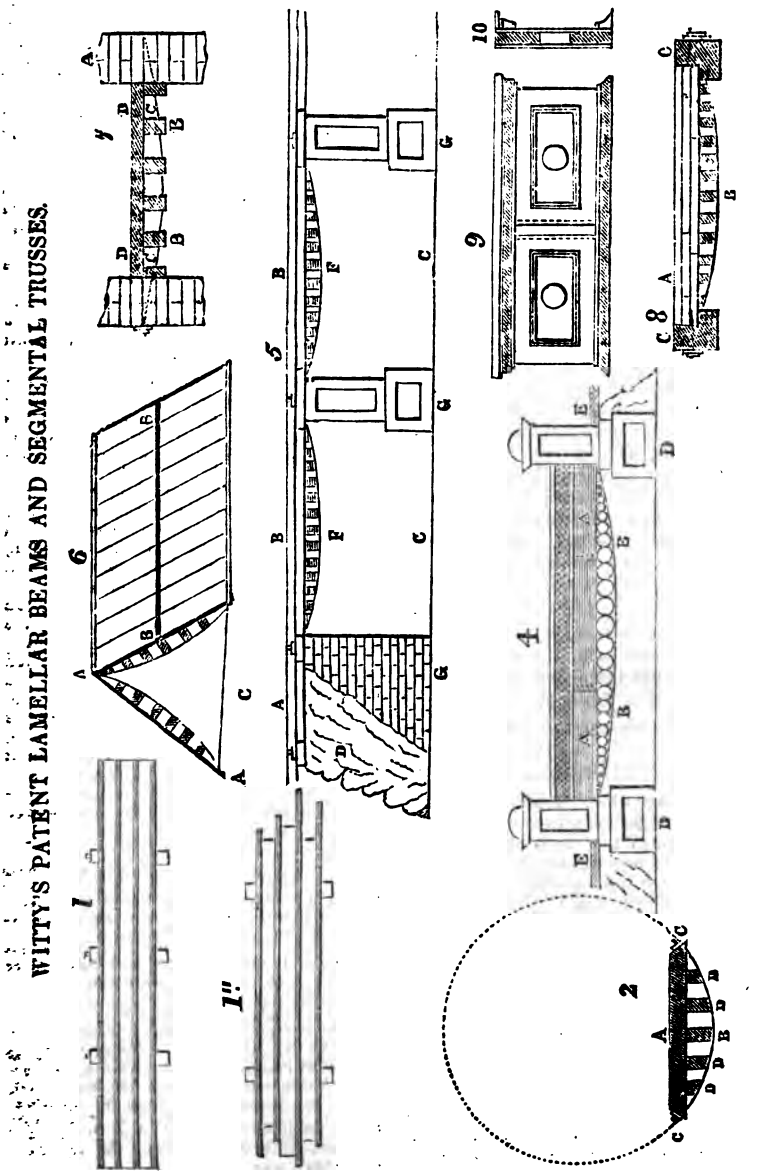
WITTY'S PATENT LAMELLAR BEAMS AND SEGMENTAL TRUSSES.



WITTY'S PATENT LAMELLAR BEAMS AND SEGMENTAL TRUSSES.

Mr. Richard Witty, already known to the engineering and mechanical world for numerous useful inventions, has recently patented what appears to us to be a very important application of two acknowledged principles in mechanics. The first is, "that the transverse strength of a beam, joist, or spar, bears a certain definite proportion to its depth, breadth, and length; also that double the depth of any beam, joist, or spar, of the same breadth and length, will bear four times the weight;" the second is, that "all materials, whether wood, iron, or any other metal, resist by cohesive power a greater force than they can bear by a transverse strain." Mr. Witty's application of the latter of these principles in the segmental hoop truss is the most valuable part of his patent, and a decided improvement in the art of building. We shall lay before our readers a description of the invention, together with an exposition of its application to various purposes, from a very clearly-written pamphlet on the subject.* We have no doubt but that as soon as the invention becomes generally known, it will be very extensively adopted, in the construction of roofs, floors, and galleries. We have our doubts as to its utility for railway-bars; quoting, however, what Mr. Booth says upon this point of the subject, we shall leave parties interested to form their wn opinions upon the matter.

First, with respect to the lamellar beam. After stating the principle first above quoted, Mr. Booth proceeds:—

"If any beam whatever was sawn into two parts lengthwise, and each piece placed and fastened upon the other edgewise, the same quantity of material would bear double the weight to what it bore before the division took place. If this plan be followed up by dividing these divisions again in the same manner as before, it will be evident that it would bear this second time twice the weight it bore by the first division; or, quadruple the weight it bore in its original state. Now, if the beam we speak of had been only ONE INCH wide in the first instance, it would have been one quarter of an inch in width after these divisions were made. It will be obvious, that no use has been made of timber so thin as one quarter of an inch broad for carrying weights in buildings, and our object is to lay before the public a plan to avail themselves of these advantages required. It is obtained by making this practical deduction, that a number of thin plates, or laminæ of wood or iron, when placed together edgewise will bear considerably more than the same quantity of wood or iron in a square and undivided form. The difficulty of putting this into practice has hitherto been owing to the great tendency of thin plates to bend or deflect sidewise, or laterally, when pressed upon by heavy weights at the top, and to the great difficulty of so binding together any number of thin plates in such a manner as to prevent that deflection from taking place. Now, by this method, the tendency of thin plates to deflect laterally is totally counteracted, and the superior strength of lamellar combinations is rendered universally available for buildings and other constructive purposes: plates or laminæ combined, may consist entirely of wood, or entirely of iron, or of wood and iron jointly. Let us take sheets of rolled iron and place them edgewise (being governed as to their number and breadth, &c. by the degree of strength required in any particular case), and let us insert between every two of the iron plates, one plate of oak, fir, &c. (charred, or painted, or plain): this being done, let us pin or bolt them together, so as to form them into one compound beam. The two outer plates should be thicker than any other, in order that they may better sustain the pressure of the pins, and resist the lateral deflection. The length, too, of these plates need not be extreme, although a long beam be required in some buildings, where great lengths of timber are eagerly sought after, and a much larger price is given than for ordinary lengths. The necessity for such extreme lengths is obviated by the facility that this plan affords. Different lengths may be so arranged, that no two ends of these plates shall coincide with those of the next row of plates, the fastening-pins may be placed at the different points of junction, which will give us the advantage of obtaining beams of any required length or depth. By reference to the accompanying drawings (see front page), fig. 1 represents a plan of a beam formed in the manner here described, where the laminæ or plates are all of the same length; and fig. 1[11] a plan of a beam in which all the plates are of different lengths, and which may be continued so as to form a

* A Popular Treatise on the Strength and Application of Materials used in Buildings in general; showing the Advantages to be derived from the Principles of the Patent of Messrs. R. Witty and Co. in all Architectural and Engineering Constructions, comprising Bridges, Viaducts, Houses, Warehouses, Railroads, &c. By G. R. Booth. pp. 35. London, J. Weale; Newcastle, W. H. Hyde.

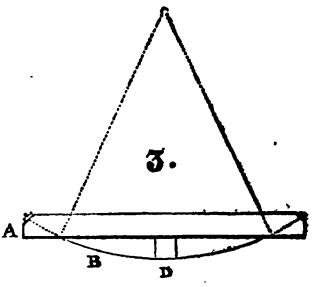
beam to erect a warehouse, or any other erection, of any desired width."

In the formation of this lamellar beam we think an important point in the nature of the strain upon a beam has been overlooked. A beam supported at each end, on its being bent by any superincumbent weight, the particles or fibres in the upper part are crushed, and those in the lower part are stretched, while there is a point where the particles or fibres are at rest. Now, it is evident, that either Mr. Witty's or a common beam would be much strengthened by a plate of iron, or some other means being used to support the upper particles or fibres of the beam from the crushing, and the lower from the stretching tendency of the weight. As it is, however, the adoption of the patent beam resolves itself into a question of weight, material, and expense.

With respect to the beam, fig. 1", which is proposed to be made of any length by the alternation of the joints of each lamina, we fear that there is too much dependance placed upon the fastening-pins.

Secondly, the segmental hoop truss:—

"If a beam were to be torn asunder by a power pulling at each end, those powers would require to be much greater than the power or weight required to break it, when placed in a transverse position, and supported at both ends; this cannot be better elucidated than by the familiar experiment made with a small walking-stick. In taking hold of it at both ends we can easily bend and break it transversely; but if the force be applied in the direction of its length, two persons cannot tear it asunder with their united strength; the power or force exerting its influence under the last named trial is called the cohesive force. It is by the application of this power we purpose to aid beams, &c. to bear a greater transverse strain, or, in other words, to enable a beam to support a much greater weight than it could otherwise—this we apply where great weights are to be borne, as a subsidiary effect to the lamellar beam at the same time, the plan will be obviously useful elsewhere. The applications may be numerous: examples offering in all buildings, both for joists, rafters floors, &c. wherever architectural and engineering constructions are required to sustain weights;—considerably less materials than by any of the known methods of girding or trussing will suffice. The mode of effecting this, is to place under the beam, *regularly* formed curves or segments of circles, or segmental hoops, secured at the ends of the beams; as will be shortly shown. The beam will form a chord line to the segment of a circle; between which and this segmental hoop, there must be placed blocks at various distances neatly fitted to the hoop, and attached only to the beam, but not to the hoop—there it must be at liberty, and to be perfectly effective should never be less in depth, than one inch in every three feet of the length of the beam. The end also of the hoop should pass through the centre of the ends of the beam, preserving the proper curvature, and having there an additional thickness of iron to screw to. Fig. 2 represents a hoop of this description, A is the beam, B the iron segment applied to the under part of the said beam and secured to the ends by the nuts and screws C C, which may be also forelocked for more security. D D D D D are blocks or stays of wood or iron, inserted at regular intervals, as noticed above. Now, by turning the nuts C C the blocks D D D D D are pressed upwards against the beam A; because the segmental hoop, when screwed up, endeavours to form itself into a straight line; the whole is thus so intimately and firmly bound together, that any weight placed upon the beam is equally distributed over the entire mass; and the beam will sustain uniformly throughout its length any properly apportioned weight. The arc of a regular circle (fig. 3,) will be



found to have superior and manifold advantages to the curve of any other form. This will be best made of strong hoop iron, or bar iron, carefully bent into a curvilinear form. One moment's reflection will develop the utility of this application; we all have noticed how small the hoops are required for a cask containing the greatest weight. Our diagram, fig. 2, is so drawn as to show that the segmental hoop we employ is simply a part of the whole hoop of a cask arranged by the peculiar attachment we have given it in the nuts and blocks. We have made this part to partake of the full power and effect of the whole hoop, as if it remained one entire part of the hoop; whereas we have detached

it, and by placing the weight in the cask upon the portion of the hoop we have reserved, we obtain nearly all the cohesive force of the iron. The weight applied upon the beam will endeavour to distend the beam, and to force down the camber given it when screwed up by the nuts. In forcing the beam down, the weight laid upon it will endeavour to distend the arc or hoop at the ends against the nuts; but the hoops now oppose their cohesive force or power to sustain the weight. In many experiments which we have tried, to ascertain the ultimate weight a beam so constructed would bear, we have proceeded as far as the ultimate practicable force of the cohesive power should be applied. We have frequently shown an experiment with two small pieces of wood and iron, which together and separately would have carried, for all useful purposes, about half a hundred weight; but when combined in the manner here described, have carried, without any injury to their tensile power, the load of six hundred weight; evidently and entirely depending upon our peculiar mode of mechanical structure. There can be no hesitation in concluding that if this subsidiary plan be added to the construction of beams, we shall thus obtain a power to sustain a load which will produce very great advantage and economy.

"In some ordinary constructions we have sustained well and permanently from fifteen to thirty times the weight which the same materials could have borne in the common mode of forming beams, &c. These advantages, therefore, must not be lost sight of, when we consider, that rails, viaducts, bridges, roofs, floors, beams, spars, rafters, joists, galleries for churches, chapels, theatres, ships' masts, decks, ribs, &c. will all, with a variety of other purposes, admit of the aid this principle lays down; we may conclude, that much benefit must accrue, and superior strength be given, at a much lighter expense than can be obtained by any other mode of construction. We have devised a rule to calculate both the dimensions of the chord or beam, as well as the size of the segmental hoops, founded upon many and various experiments, undertaken with great care, and conducted by accurate observations, not only by ourselves, but aided by some practical and scientific friends; the result has thrown new light upon this branch of mechanical science, varying greatly from what would have been the supposed result, and fully bearing out the statement relative to carrying the weight we have previously named.

"There is another feature in this plan that we have not touched upon. From the effect the application of the segmental hoop has upon the beam, it is clear there can be no outward pressure upon the supports; the walls of a building cannot be oppressed with any outward thrust, as in the case of common beams, the whole superincumbent weight being confined and bound up in the beam. We shall see this more particularly exemplified when we come to treat upon bridges; here we may remark, that the walls do not need to be constructed so stoutly as in ordinary buildings. The strength required being that they should support themselves and any perpendicular weights placed upon them, by such beams; since our beams simply press or rest upon the walls, in a vertical position (not exerting any lateral thrust), which will effect some considerable saving in the outlay: thus this beam will likewise give greater safety to buildings, for if the weight be placed upon the walls, it will be more securely supported than by the weight pushing outward or against the walls, which in a great measure is done by the ordinary beam."

We shall now quote Mr. Booth's exposition of the methods and advantages of applying the two principles, together and separately, to various constructions:—

"*Bridges.*—Fig. 4 represents a bridge, constructed according to the improved plans for beams; A A is a laminated beam, which forms the balustrade, with an ornamental railing at the top; B B is one of the segmental hoops secured to the ends of the beam A A; D D are pillars or piers; E E the roadway. Having described the figure in this cursory manner, we proceed to show the strength of the materials for such a construction, taking certain dimensions calculated for practical purposes. Suppose it be required to erect a bridge, 30 feet span, 12 feet wide, to carry 10 tons; by the common principles of calculation we find a plate of wrought-iron (for we shall use boiler plates,) 30 feet long, nearly 1 inch wide and 24 inches deep, placed edgewise, will carry 10 tons. Let this plate be divided into four plates, in its longitudinal direction, we thus shall have four plates, each 30 feet long, 0·25 inches wide, and 24 inches deep, a little extra length must be allowed for bearings, say 18 inches at each end. These plates may be made out of a number of lesser or shorter plates; let each be 6 feet long, and rivetted to the succeeding plate, in the usual manner of fastening boiler plates together, except that the pins or rivets need not be so numerous, about ten rivets to each plate will suffice. Having done this, we will take two plates, one on each side, to form one balustrude of the whole length of the bridge, fastening them to each other, side by side, with screws, bolts, or pins, upon the lamellar principle, and placing at intervals between them (where the pins perforate the sides), blocks of wood, so as to keep each plate at the distance of 4 or 6 inches from

each other. Let them now be closely screwed up, being firmly fixed upon the walls or piers: a stone or cast-iron cap at the top of the pillar will form the bearing for the bridge. Upon this laminated beam, must be placed a sill of wood or iron, upon which also any kind of ornamental work may be affixed, as a surmounting finish. We now proceed to notice, in the next place, the mode of making the roadway, which must be subtended from the sides, or have laminated beams across the bridge from one side to the other; this is effected by affixing a piece of iron, ½ inch thick and 2 inches wide, in a line with the rivets from the top to the bottom of the laminated sides, and underneath the rivets fastened on with them or screwed on by the same pins, &c. that fasten the two pieces of the laminated sides and blocks together. This piece must descend below the bottom of the sides, and be returned inward, forming a right angle at the bottom for the oak or iron beam to rest upon, which stretches from side to side, and which beam forms a chord line, with a segmental hoop going across the road, the hoop is then affixed underneath the beam, passing through the sides of the laminated beam and upright bar, and screwed on the outside with proper washers fitted underneath the nuts, so as to make the screws at right angles with the nuts: thus, then, the two sides will be connected and bound together by this beam of wood or iron. The segmental hoops may be varied in number according to the mode intended to cover the roadway. If one were placed every 6 feet, then five such beams would suffice; which might be overlaid by oak planks of 3 inches thick, 5 feet long, or by iron net-work having a superstratum of macadamised stone; thus a strong covering would be made for the roadway."

Railway-bars.—After some remarks upon the controversy between Professor Barlow and Lieutenant Lecount upon this subject, Mr. Booth proceeds to state Mr. Witty's plan:—

"We purpose to divide the 1·25 inches of iron into four parts, longitudinally, or in the direction of its length; or to take 2 plates each ·25 inches, and two others ·375 inches, placing between these laminæ of iron, 3 pieces of oak of equal lengths with them, ·412 inches in thickness, thus forming a rail 2·5 inches wide. Considering the bearings to be 4 feet as before, the oak itself will carry 1718lbs. which, if added to 6875lbs.=8593lbs. carried by this rail, *being double the weight carried by the common rail*, as before-named, *yet having the same weight of iron only*. If, as on the Manchester and Liverpool line, rails of 60lbs. per yard carry 5 feet, these will carry 9 or 10 feet, and in a distance of 50 feet the saving in blocks would be 5. Now, look at it in another shape. If the blocks are put every 5 feet, then one-half the strength of the iron laminæ, with a proportionate increase in the strength of the oak, will give all the strength or power wanted, by taking 30lbs. of iron in lieu of 60lbs. to the yard. Nevertheless, we cannot suffer to escape the opportunity of making a further saving. Hitherto we have confined ourselves to the law laid down for certain dimensions, in the depth of the rails; did we see any just reason why these should be closely followed, we might stop there. Let us avail ourselves in every point, with our advantage over every other plan. Let the rails be made double the ordinary depth, reserving the same quantity of iron, but making it half the thickness, we shall then be enabled to carry double the weight; and keep the rails of the same width, by increasing the width of the oak as much as we decrease the width of the iron; if the blocks be only 4 feet asunder, we shall now carry 17,186lbs. per yard, but as it is only needful to carry 4134lbs., we have strength enough to place the blocks 16 feet asunder; and if the bearings, as in some instances, are placed 6 feet asunder, 20 feet may be the distance, thus saving 7 blocks out of 10, and gaining this superior strength. It is perfectly understood, that the laminæ of wood and iron shall be screwed or bolted together at proper intervals, in parts where the bearings shall be great; we purpose also that rods should extend from one rail across the tram-road to strengthen and keep parallel the opposite rail; being screwed or bolted on each side of each rail, to hinder any lateral deflection; the bars so used are subjected only to a longitudinal pull, and require to be of small thickness.

* * * * *

"*Viaducts, comprising Rail and Railway in one Construction.*—Upon referring to fig. 5, will be seen a railway similarly constructed to the rail we have been treating upon, varying only in its dimensions or depth. In that part of the road where it rests upon the embankment D, the rail A is formed of the ordinary dimensions, 2½ inches wide, 5 inches deep, and laminated with alternate pieces of wood and iron; B B are the other two laminated rails of greater depth than A, having to cross the valley C C; these rest upon the pillars G G G.—F F are segmental hoops, used as before described, being screwed at the ends or sides of the laminated rails B B. These laminæ may be disposed to comprise two objects, either to be the rails themselves, or to be beams for the support of the rails, and combined with them.

"Let us suppose a viaduct and railway requiring 9 arches, each arch to be 50 feet span. Instead of proceeding in the common mode, similarly to the viaduct across the Sankey

Valley, our plan would not require any arches, nor in the pillars any of that strength, with which abutments must necessarily be furnished for the support of arches. We shall simply continue the rails from pillar to pillar, instead of from block to block, upon the level plane; but as the span is greater from pillar to pillar than from block to block, and the weight consequently greater, we must have the rails made of laminæ deep enough to bear the weight.

* * * * *

"*Roofs and Floors.*—Fig. 6 represents a roof made according to this improved method; A A are two principal spars, so called because they are made stronger than the other spars, calculated to bear according to the weight to be carried, and generally about double the depth of the other spars; these are seen in the drawing, with the segmental hoop attached to them, and the stays as before described. The purlins B B are made in like manner, and stretch from one principal spar to another, which are placed at proper intervals in the roof, say about every eleventh; the stays underneath these purlins are fixed with most advantage underneath each spar. In some cases we have found that instead of a piece of timber (the present purlin) stretching from one principal spar to another principal spar, short pieces of wood of the same dimensions as the spars themselves are quite sufficient from spar to spar, i.e. between each spar. The stay-pieces in this case must be direct against and underneath the spars, with their feet resting upon the segmental hoop. Some little timber is thus saved, and an opportunity afforded for using up the small pieces that are always to be found about a building. C C are rods of iron carried across the building at the foot of the roof, and through each wall-plate to tie the roof togetheir, their longitudinal pull being calculated at about 6 tons per square inch.

"It will be evident, that by such arrangements the main beam, king-posts, and other cumbrous appendages in ordinary roofs, may be wholly dispensed with. There will be found power sufficient to carry any weight, whether the roof be of slate, tiles, lead, or iron. The dimensions of the spars need only be sufficiently wide to give space to drive the nails without fear of splitting them; all other purposes for bearing weight being supplied by the segmental hoops. We beg to refer our readers to our drawings and calculations upon roofs, the mode of fitting up the spars, hoops, &c. they will be found most simple and effective. All questions required, in order that these particulars may be furnished at any time, may be summed up as follows, viz.:—

"1. The length and thickness of the wall-plate or of the building.

"2. The leugth of the spar and the width of the building.

"3. Whether to be covered with tiles or slates.

"Fig. 7 will lead us to the plan for fitting up floors; this mode consists of two parts, differing much in their manner, but producing the same result; the one adopting part of the present system to procure the same appearances in a room as by common construction; the other a novel invention, thereby giving scope for further improvement, and out of the common wearied and beaten track of centuries for constructing ceilings. Great ornamental effect, combined with great simplicity, may be produced at much less expense than by lath and plaster ceilings. A A are the walls of the building; B B, the joists; C C, the segmental hoop carried through and underneath the joints; D D, the floor. In looking into the nature of such constructions, the following may be seen as some of the advantages to gain superior strength, and the mode of applying this patent. Suppose a floor 20 feet square is to be laid, let the spars be placed at the usual distances of 1 foot 6 inches from each other, let them be 5 inches deep, but of such a width, that, with the assistance of the segmental hoops, they may bear an equal burden in all parts of the floor; the hoops shall be placed every 5 feet asunder, thus requiring three hoops of very slight width and thickness, having their ends passing through the walls, or placed within them. If this floor had been made upon the ordinary plan for common purposes, spars 11 inch × 3 inch × 20 feet must have been used: the difference in timber, therefore, is manifest, while the extra expense of some 1 cwt. or 1¼ cwt. of iron will effect all the rest. It will be proper to strut the joists from one to another by any scrap pieces of timber that may be found about the building, as it will be seen that the straps go cross-wise or through the spars, and contrary to the plan before laid down for the beams, an ordinary floor may now be fitted on, and our work is completed; with this one difference, that we have a power to sustain permanently and securely a much greater weight than the timber named above could sustain, nor is it subject to the same *undulating motion* when walked upon. A proper firmness and rigidity being obtained, which can be procured only with great difficulty and expense, when the spars are made of wood entirely.

"Fig. 8 represents a compound floor constructed according to our improved method, but without joists for either floor or ceiling, and partaking of the nature and application of the laminated beam, but being used hori-

zontally instead of vertically. A is the floor, the boards being arranged some diagonally and some at right angles upon each other, and nailed together; B is one of a series of segmental hoops stretching underneath the floor and fastened to and through the wall plates C C; D D are stays, stretching from the floor to the hoops; thus it will be seen that with the addition of a little extra wood for the floor board, joists, &c. are useless. A floor 20 feet square would require four straps, as named in fig. 7, instead of three, and an additional half inch of timber, or three boards of half inch each would make a floor equally as sound for bearing weight as the one planned under No. 7, the ceiling would at once be made, avoiding the necessity of lath and plaister, and might be ornamented with reeding round the hoops and in place of the usual cornice. In some floors we would recommend an interior layer of brown paper between the ranges of the boards; the whole is then to be nailed together with strong sprigs and well turned."

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"*Galleries.*—A laminated beam of a sufficient depth to form the front of the gallery and resting upon the end walls would require neither beam nor pillars to support it. Upon the foot of this beam, spars might be placed, stretching from it to the back wall for the foundation of the gallery, and thus the other rows of the pews may be projected.

"This plan may be varied by doing away the spars above spoken of, and each row of the pews in the gallery may be supported by laminated beams, placed and affixed from wall to wall as in the instance of the front of the gallery; but underneath and as high as the seat in the back of each pew, aiding in part the erection and formation of the pew, and being not only a support for the seat in one pew, but giving a support for the floor of the pew behind it (see fig. 9). Much greater head-room will thus be given underneath the gallery, and a great saving effected."

MODE DISCOVERED OF PROPELLING BALLOONS IN ANY DIRECTION.

Sir,—It is really a matter of no small surprise, that, after all the investigations and experiments made in aerostation, since Albert first asserted, and Montgolfier afterwards demonstrated, the practicability of floating in the upper regions of the atmosphere, that balloons should remain to this day the same unwieldy and ungovernable toys as at first constructed.

After the first principle, or rather the first power of balloons—that of ascension—had been satisfactorily established, both by calculation and experiment, the next thing that became desirable was the power of propelling and guiding them at will.

Various attempts have at different times been made to accomplish this eminently desirable object; but being for the most part made without judgment, they were unattended with successful results. Sufficient has been done, however, to prove beyond all question, *that propellers will act upon a balloon*, with an effect proportionate to their size, and to the manner in which they are placed and worked. It is also equally evident, that so soon as aeronauts can, by any means, cause their balloon to move with a velocity differing from that of the current of air in which they are floating, a rudder will become efficient, and the balloon will answer to the helm.

People frequently confuse themselves in their application of the simple principles of navigation in a denser medium *to aerial navigation.*

So long as a boat, barge, &c. moves with the same velocity as the stream, a rudder is wholly useless; but, if the boat or barge is made to move with a different velocity—i. e. *either faster or slower* than the stream—the rudder becomes an efficient agent in directing the movements of the vessel. With balloons, precisely the same law obtains; the moment they can be propelled, they will become capable of being guided.

In a recent Number of your Magazine, Mr. Mackintosh very justly observed, with respect to the difficulty of propulsion, that "the difficulty consists simply in this:—The resistance is greater than any power that has been hitherto applied to overcome it." He further adds, "To meet this difficulty we must *increase the power*, and *decrease the resistance*."

Mr. Mackintosh's reasoning upon this subject is perfectly correct; and I have now to state, that following out precisely the same principle, I have succeeded in contriving a balloon of an entirely new description, possessing all the requisites for efficient aerial navigation, and capable of being propelled and guided at the pleasure of the aeronauts. The few scientific friends to whom I have submitted my plans, have expressed themselves perfectly convinced of their feasibility, and feel satisfied that the time has

now arrived when balloons will cease to be scientific toys, and assume a new and useful character.

It would not be consistent with my own personal interest, at this time, to develop the nature of my invention, but your readers will hereafter have an opportunity of becoming acquainted with it. I should wish no person to suppose for one moment that balloons will ever be guided in the teeth of opposing currents; but I am now prepared to assert, and all who have examined my scheme will support my position—that in balloons upon my construction, the power is so much increased and the resistance so much diminished, as to enable them to be propelled and guided through the air with as much facility as boats at present are upon the surface of our river Thames.

By the same means, an upward or downward direction can be given to a balloon, without in any way varying the quantity of gas or of ballast—and the machine brought under a degree of control hardly before anticipated.

I remain, Sir, yours respectfully,

WM. BADDELEY.

Oct. 11, 1836.

COLONEL MACERONI'S OUTLINES OF A THEORY OF THE UNIVERSE. GALVANIC ACTION — FALLING STARS — IDENTITY OF MATTER, &c.

Letter II.

For the sake of brevity, I will skip over electricity, which is a mere artificial excitation and exhibition of the base of all things, to say a word on galvanism. The galvanic action is an excitation communicated to certain substances, through which they are provoked to an energy of expansion, that is, of separation, which produces phenomena more apparent to our senses than such action would be without such superposition or arrangement. If we place together two pieces of copper, for instance (the degree of action of the two being equal), the product only induces an equilibrium of mixture, that is to say, *two* pieces of a given substance are just as though there were only *one*. But if we place in juxta-position two bodies of analogous natures, but of *different* capabilities of internal expansion, the one of these bodies which is the most active in expansive force will give out a major, the other a minor fluid. A plate of copper placed upon a plate of zinc, it follows that all the molecules of the major order (the North Pole) flow to one of the two, that is, to the most dilated and active, and, expelled by the internal expansion, *they are accumulated on the surface of that plate*, as they cannot be contained within it. On the other hand, all the molecules of the minor order, contained in the two plates, are thronged upon the more condensed plate, and remain in abeyance on its exterior. We here have the complete magnet—the face of the zinc is the major pole, that of the copper the minor. The space between them is the neutral ground, or region of *indifference*. The addition of water increases the expansion, separation, circulation, and escape of the molecules of the metals, by acting as a conductor and stimulant. If you wish to increase the exit of galvanic fluid, i. e. the emanations of the substance of the metals, submit the pile to mechanical pressure—and just as you would force water out of a sponge, so will you expel a greater quantity of organic fluid (the galvanic) out of the metals. The water and salt, or acid, not only serves as an excitant and a conductor to the expansive products of the couple of metals, but, *by its decomposition, furnishes molecules of a perfectly similar nature to those of the metals.* If the pile be isolated, the centre of it is neutral, and in equilibrium of mixture; but if the lower extremity communicate with the earth, the intensity of action is very greatly increased; because the expansive fluid is received from an indefinite extent of surface, that is, from the earth itself. A double flow now takes place; from the earth to the column, and from the column to the earth. The minor fluid now flows from the superior extremity of the column into the earth. The major fluid ascends from the earth into the column with great intensity, so that it is now at the superior extremity only that a great accumulation of electric fluid is established. In this state of things, the pile resembles the Leyden bottle, as at its upper extremity it will give out sparks; and if with the hands you touch, at one and the same time, the two extremities, a commotion will be felt. That the emanations, or expansive perspiration of the earth, is identical with

the galvanic fluid, that is, with the expansive emanations of the intimate substance of the metals composing the pile, is evident, because the mere fact of effecting a communication with the earth produces a vast increase in the quantity of one and the same identical fluid.

Disks or plates of all bodies, not in a state of decomposition or death, such as flesh, orange-peel, potatoes, fish, apples, &c. will, placed in alternate layers, give forth their substance in the way we call galvanic. Thus we see that the same expansive products are derived from the metals, salt and water, the acids, the magnetic bar, all other bodies, and the emanations of the globe, and that therefore they are identical.

Another point to which I would wish to call attention, though this is not the proper moment for introducing it, is the identity of the matter of cosmolithes with that of which our earth is formed. For these many years past I have attended to, and thought upon, that subject with increasing interest. The usual explanation of the nature of what are called *falling stars*, could never give me any satisfaction, even when a school-boy. I was told that they were caused by inflammable exhalations, or gases, which suddenly took fire in the upper regions, &c. But in what sort of bags or bottles these gases were collected and retained, separate from the surrounding atmosphere, deponents did not, nor *do* they say. In the midst of the ocean, on a clear, star-light night, many an hour have I laid upon my back on deck, watching the motions of these minor "heavenly" bodies—these sprats of space, that serve as food for stars and globes of whale-like magnitude. During the first series of ages which followed the formation of this globe, it is evident that the internal expansive agitation was with much difficulty confined by the surrounding compressing forces. Volcanic explosions, on a scale of enormous magnitude, at various periods rent the surface of the globe, and gave a temporary vent to the strife within. The *evidences* of these early outbreakings of the expansive action of our globe are on a scale that leave those of more recent times in the comparison of "Ossa to a wart." Many of the most ancient volcanic craters occupied an area of several hundred square miles, and have sent forth torrents of basaltic, tuffic, and other lavas, amounting to the mass of entire continents. If from the comparatively puny, squib-like craters of Chimborazzo, Etna, and Vesuvius, we see the liquid incandescent matter of this earth's interior, thrown to the height of 20,000 feet, what may not have been the distance from the surface of the globe to which these first volcanoes did project their emanations? The stars, or suns, which people universal space, are also subject to the same universal law of internal expansion—external compression—to the periods of infancy or flaccidity; increasing solidity, external density; internal agitation and impatience of compression; irruptions, at first more violent, but which become in time less frequent and less powerful.

Modern astronomers inform us, that many of the stars are to be seen in a state of great agitation. Others have been seen to wane and then revive, and then disappear. What may be the power of the first irruption from a globe a million of times the size of this our earth? Such was the power, which hurling from the bowels of "our" sun, the products of one of those convulsive efforts of his internal expansive action in the period of his youth, which formed our globe and all our sister planets. The ejected matter, at first, existing in a fluid, pulverulent and gaseous state, was, in its progress through the regions of space, seized and on all points compressed by the universal stellar emanations, so as to become compacted into the globe, as we see occur to a drop of water, an isolated portion of mercury, or of any other substance in a fluid state. The larger ejections, of course, were propelled the furthest, and formed the planets Jupiter and Saturn, which being accompanied by some smaller fragments and nebulous matter, satellites were formed, and the rapid rotation of the nebulous substance caused it to revolve around the planet, as those rings of smoke we often see projected to a great distance from the mouth of a cannon, or from a common tobacco-pipe. Besides, the masses proceeding from these irruptions of the innumerable globes and suns, which are of a size sufficient to form a planet of permanent visibility to us, there must needs be countless millions of others of every variety of dimensions, all traversing the realms of space in every direction. Such of these as are not of a mass sufficient to contain electrical repulsive

power competent to their repulsion from the globes which they approach, must fall on to the surface of such globes, and become integral parts thereof. A body projected from the surface of a sphere, itself in rapid revolution round its axis, describes a curve, which increases in its flexure as it recedes from whence it came. The orbicular rotation of our earth, and of all our sister planets, is in the sense of the sun's rotation on its axis; so is the rotation of the planets on their axes, and the rotation of their satellites is the same.

I have already observed, that the expansive force of all globes is in proportion to their mass. The smaller the globe, the greater is its extent of surface in proportion to the mass. So that, at last, the minute particles, even of the heaviest metals, becoming, as it were, all surface, the action of the internal parts is greatly overbalanced by the resistance of the proportionately vast surface. The matter cast from the irruption of a star or planet, at first, is fluid even to its centre. Its outer parts are still more dilated, and thus it occupies a space immeasurably greater than that to which the stellar pressure will by degrees reduce it. The electric expansive action of its interior substance is also, in regular and sure progression, on the wane. Hence that power which, for a period, enabled the little cosmolithe to play, in some degree, the part of a comet or a planet, dies away. Becoming more and more condensed and powerless, it falls on to the surface of the globe the nearest to it. On Mount Jura there lays a cosmolithe weighing upwards of 80 tons; it is principally of iron, in some parts perfectly soft and malleable. The far greater number of aerolithes or cosmolithes, which are apparent on the surface of our globe, are found towards the poles; and this, again, is indicative of those parts being less repulsive to approaching bodies than those of the equator, from which proceeds with greater energy the electric products of the earth's expansive intestine action. I know of a spot in Kent, on which, in the compass of a few acres, there are as many cosmolithes as would fill 50 carts. They are very minute, that is, not bigger than an egg. The identity of all the matter of which the universe is composed is evident, from stellar and solar emanations which our earth receives, being identical with that which it projects from its most interior recesses, in the shape of insensible perspiration, that is, heat or galvanic fluid. We further see that the solid bodies proceeding from the sun, or some other globe, are perfectly identical with the condensed substance of our globe.

To return to the subject of the ONE primitive elementary constituent of *all* things — the TO PAN, commonly, and I say, *indifferently*, named light, calorie, the galvanic, electric, or magnetic fluid— I proceed to observe, that if we attach two wires, one to the major, the other to the minor pole of a Voltaic pile or battery, and pass those wires into the interior of a glass tube *not quite full* of water; and if we approach the ends of the wires towards each other, so that there shall be but a short interval between them, the following familiar phenomenon will take place. From the extremity of one of the wires proceeds a current of the major fluid, from the other a current of the minor fluid. Before they can combine, they are forced to pass through the water. Small bubbles of air gas are seen rapidly to collect upon the ends of the wires, and the water in the tube sensibly diminishes in quantity. The gas thus produced is found to be of two different natures; the major pole has produced oxygen gas; the minor has furnished hydrogen; and the volume of the latter is just double that of the former. It is important to remark, that this mutation will not take place if the tube is *quite full* of water, as in such case it is not at liberty to expand. This operation is erroneously called *the decomposition* of water. By the "decomposition" of a body, either fluid or solid, is meant the separation of the two, three, or more substances of which that body is composed; but then we must show what has become of the substance which we employed to effect the operation. Tartaric acid, for instance, added to a solution of carbonate of soda, having a greater affinity for the soda than has the carbonic acid gas, forms the tartaret of soda, and sets free the gas, which bubbles over the edges of our goblet. Thus, as in other chemical cases, we see what has become of the whole party. But in the case of the streams of galvanic fluid introduced into the water, confined in a close cylinder of glass, what becomes of that? What is the *modus operandi*? Why, I think it will be allowed, on further investigation,

and, above all, by further cogitation (for the *facts* are established), that it is the galvanic fluid itself which is converted into the gases. This union of the electric, or galvanic, or magnetic fluid with water is, in all cases, the first step towards organisation. By this *duality*, elastic vibrating hollow globes are formed. But first to the experiment. From the Voltaic pile, or other galvanic or electric apparatus, a stream from the major and another from the minor pole is introduced, as above, into the water. The points of the wires being at a certain distance from each other, only a part of the galvanic fluids are able to find their way back into the column, by means of the conducting power of the water. The remainder of the galvanic fluid, seized upon by the water, is, in each of its atoms, covered with a little crust or shell of water. On this shell the gas re-acts, and so is constituted into a little elastic ball of the major order, which we call oxygen gas. The fluid from the minor pole being seized upon by the water, in a similar manner, gas of the minor order or hydrogen is produced. If it were now possible to place an atom of one of these gases upon one of the other, we should constitute a galvanic pile, or a magnet in miniature. Now these two gases, the major and the minor, or oxygen and hydrogen, being allowed to enter with perfect tranquillity a glass vessel, will take, one the lower part of the vessel, the other the upper. But we must have two volumes of the hydrogen or minor fluid, for one of oxygen or the major. The globules of oxygen are twice the size of those of hydrogen, but the latter possess double the expansive mobility of the former, which causes an otherwise equal mass to occupy double the space. The two gases being placed together in a closed glass vessel, assume of themselves a real magnetic condition of electric couples, so as to be like the magnetic bar or Voltaic pile, in a state of equilibrium of separation. The internal expansion of each particle disposes the whole to unite in an equilibrium of mixture, but the capsules of water surrounding every atom are in the way. But subject the mass to a violent action, pass through it an electric discharge, or strike it with a sudden pressure, a strong commotion is excited amongst the globules; the sides of the containing vessel do not cede; the capsules enveloping every atom, are broken with an explosive force; the magnetic fluids are liberated; heat is felt and light exhibited; and the hollow globes of water lose their shape and temporary office, remain collected in common drops of water on the interior of the recipient. Thus we have another very evident proof of the identity of the matter of the universe, of the galvanic fluid, calorie, light, and the hydrogen and oxygen gases.

If I can manage to proceed with these disquisitions, I think I shall be able to show, that it is the superposition of such globules of gas combined with water, which becoming susceptible of the galvanic and magnetic action, acquire a major and a minor pole, and proceed to the development of animal and vegetable life. It will soon be clearly understood, that every act of production and reproduction; every act of nutrition and growth; every function of the internal parts—the brain, heart, stomach, intestines—is deducible to the electric, galvanic or magnetic action. The first step is the elastic globule; duality follows; additions form filaments; filaments form tubes; two distinct poles follow, one aspiring, the other expelling; ramifications, always subject to duality (an arm, or branch, or leg, on each side), and other double organs, &c.

I will now just, *en passant*, remind your readers of one other indication of the identity of all matter, which is familiar to us all, this is, the formation of very different substances in various parts of organised bodies, although but one species of alimentary substance be introduction to the action of the digestive and secreting organs. There are many thousands of people who live exclusively upon rice, yet their bones are supplied with phosphate of lime, their teeth with lime and silica, their blood with iron, their fat with carbon, their nails and hair with ammonia, &c. I have fed hens for many months exclusively on oats, yet they produced abundant eggs, the shells of which are lime, the whites albumen, the yolks containing sulphur. From whence do the oysters and other shell-fish, especially the corallines and other zoophites, derive their enormous quantities of lime; quantities which form chains of mountains on this globe, and raise up from the bottom of the sea those mountainous reefs upon

which navigators have been wrecked, after having sailed over the same spot in deep water some few years before? How is it that *recent* oyster-shells are formed of *phosphate* of lime—whereas the mountains of agglomerated fossil-shells of the very same species consist of *carbonate* of lime? Starch, sugar, and wax, are composed, as nearly as possible, of the same proportions of oxygen, hydrogen, and carbon. Water appears to us as a very Proteus; yet custom familiarises us to the metamorphosis. Water is fluid, is solid as ice; disappears in gas, when combined with the magnetic fluid: is solidified in the flint, and crystals, and the bit of lime; is suspended in perfect and invisible solution in the air which we respire. But enough; on this head we shall probably speak again at a more fitting juncture.

Before proceeding any further on the subject of the electric or magnetic action on organised bodies, I will venture a hint about the tides, on which subject many of your intelligent correspondents have favoured us with their ideas. The surface of this globe being impinged upon and compressed on all sides by the expansive emanations of the INFINITE number of suns or stars, *of which this globe, as well as every other, is in the centre*, it necessarily follows that any large body intervening on a given point between this earth and the stellar pressure, at that point so screened the pressure will be diminished. Moreover, this globe is surrounded to a certain height with an elastic atmosphere, in the midst of which this globe is, as it were, suspended. As the sun or moon proceed to interpose their masses between the earth and the stellar pressure, the waters will not only be disposed to rise, but the balloon-like, elastic atmosphere being drawn forward on one side, necessarily assumes the shape of an ellipsis, or egg, so as to form a corresponding elevation of the waters on the side *opposite* to the rise occasioned by the interposition of the sun or moon, or both. The course of the moon around the earth is not very far removed from being in the plane of the equator; so that the successive rising of the waters, or the longest axis of the double cone, is nearly perpendicular to the meridian, being in a line with the centre of the earth and that of the moon. Hence the waters at the poles are constantly compressed and forced to flow towards the equator as the double cone moves round. Thus at the poles there can be no tides, and in latitude 66° they cease to be sensible. The Caspian and the White Seas, having no communication with the waters of the poles or of the ocean, have no tides. Neither are there any in the Black Sea or the Mediterranean; because the course of the rising action, being from east to west, is contrary to the direction of the only entrance to the Mediterranean (the Straits of Gibraltar), and also to the current with which the waters of the ocean are constantly pouring into the Mediterranean. The effect of the moon on the rise of the tide is three times greater than that of the sun, although by theory it ought to be only in proportion to the squares of their apparent diameters, which differ only in the ratio of 34 to 32. The reason of this is, that the expansive emanations or light of the sun itself act upon the earth with a very great power of compression; whereas the expansive emanations of the moon are absolutely null as to any compressive effect upon the surface of our globe. The fact of the sun's acting on the tides with so much less proportionate effect than the moon, leads us to the important conclusion, that the quantum of impulsion applied to the surface of this globe, which is intercepted by the body of the sun, is much greater than the impulsion projected by the sun itself. If the projection of the sun's expansive force, or light, were equal to the stellar projections which he arrests, he would produce no effect whatever on the tides.

On an early occasion I will endeavour to follow up these remarks. Meantime,

Yours, &c.

F. MACERONI.

Oct. 6, 1836.

WILKINSON'S ALARM.

Sir,—Among the "Notes and Notices" in your 687th Number, I observe one describing an "*alarm-lamp*," said to be invented by a gunsmith of Easingwold, in Yorkshire. I apprehend the writer has made some slight mistake with respect to this invention, which originated with Mr. Wilkinson, the justly celebrated gunsmith of Pall Mall, London.

Having constructed a percussion-lock upon a new principle about fifteen months

ago, which I considered applicable to large pieces of ordnance, and knowing Mr. Wilkinson to be the very best authority upon these matters, I obtained an introduction to him. Mr. Wilkinson received me with the utmost politeness; and having examined my new lock, he pointed out, in the kindest manner possible, the reasons why it could not answer the purpose for which I had intended it. He then exhibited and explained to me many curious and ingenious things with which I found him surrounded, and, among other things, he showed me his new alarm for the detection of poachers, rick-burners, &c. This alarm consisted of a percussion-lock of a very strong and durable construction, fixed upon a stout post, from which wires were led in various directions over the grounds to be protected, in the same way as the wires of spring-guns used to be. The lock is made to communicate with a rocket or a maroon, or with both. In the event of any of the wires being touched, the lock is discharged, and striking a percussion-cap, ignites the maroon, the audible report of which alarms the persons who are on the look-out; a rocket at the same instant ascends, and remains stationary for five or ten minutes over the spot, throwing down a vivid light, which indicates the situation, and exhibits the progress of the depredators.

Mr. Wilkinson's alarm has been very extensively employed by noblemen and gentlemen for the protection of their property from midnight marauders, and it is the best contrivance for the purpose I ever met with. These alarms are in every way infinitely superior to the inhuman "man-traps and spring-guns," even were they still legal; they are properly described as "being perfectly free from danger to servants or others having the care of them; but calculated when they go off to strike terror into the breast of the most audacious depredator."

I remain, Sir, yours respectfully,

WM. BADDELEY.

London, Oct. 8, 1836.

ANALYSIS OF RAW SILK. BY MR. J. W. LAIDLAY.

A. A hundred grains of yellow raw silk were digested in moderately strong alcohol, which soon assumed a fine orange tint. At the end of some days, much colour remaining unremoved, heat was applied, and the solution boiled. The alcohol was then decanted, and successive portions of the same solvent were employed, till the silk appeared perfectly decolorised (decolorated). The solutions were then reduced to a moderate compass by distillation, and on cooling, deposited a feeble, cloudy precipitate, which subsided slowly. The clear fluid being decanted, and evaporated at a gentle heat, to dryness, left a deep orange brown mass which weighed 0·9 grains. This substance was adhesive, fusible, scarcely, if at all, soluble in water, but readily so in alcohol, to which, in small proportions, it communicated a fine orange tint. A concentrated solution deposits on cooling a vast number of minute shining crystals, which subside to the bottom in the form of a brilliant orange-brown powder. When this precipitation has ceased, the solution lets fall, by spontaneous evaporation, a few filamentous bunches of a white colour, and apparently fatty nature; but in quantity too small for more particular examination.

B. The flocculent precipitate above-mentioned, being collected and dried, weighed 0·1. It had the consistency, fusibility, and other sensible properties of wax.

C. The silk, still perfectly elastic, was now transferred to a deep silver vessel, and boiled with successive portions of distilled water as long as any sensible action was produced. A colourless, opalescent solution was obtained. It was frothy and viscid; and exhibited scarce any tendency to deposit the particles it held in suspension. A solution of bi-chloride of mercury, cautiously dropped from a graduated tube, threw down a bulky coagulum, which, after boiling, became much condensed, and permitted the easy decantation of the clear fluid. This precipitate, well washed and dried, weighed (deducting 1·4 grains, the amount of metallic salt employed,) 8·9 grains. It had all the well known characteristics of albumen.

D. The clear fluid decanted in process C, being evaporated to dryness in a steam-bath left a nearly colourless, transparent, brittle mass, resembling gum. It weighed 13·0 grains, and had a tendency to soften, from the presence of a small quantity of deliquescent salts. It dissolved readily in water, from which neither the bi-chloride nor tan threw it down. It exhibited no tendency to gelatinise, however concentrated; and was copiously precipitated by sub-acetate of lead.

E. Alcohol now took but a feeble tinge from the silk, which still retained a little harshness. A very dilute solution of caustic potash was accordingly exhibited; and after a few hours' digestion, was poured off, exactly neutralised with muriatic acid, and treated with the bi-chloride as in process C. The precipitate of albumen thus obtained, weighed 0·4 grains.

F. Finally, the silky fire, which had now attained its full lustre and flexibility, weighed 76·5; exhibiting a loss of 0·6 upon the total, attributable to hygrometric moisture; the whole of the products being dried at a steam heat immediately before weighment. The following are the results of the analysis:—

A. Resinous colouring matter, and white filamentous substance	0·9
B. Wax	0·1
C. and E. albumen	8·9
D. Mucus	13·0
E. Bleached fibre.....	76·5
F. Hygrometric moisture	0·6
Grains....	100·0

An analysis of white silk gave identical products; and in amount differing only fractionally from the above; except in the particular of the resinous colouring matter, which was indeed present, but in a very much smaller proportion. It is probable that the varieties of colour observable in cocoons, the yellow, the orange, the buff, the white, and the greenish hues, depend only upon the greater or less amount of this resin in the fibre.—*Journal of the Asiatic Society of Bengal*, vol. iv. p. 710.

WATER-TANKS.

At the late meeting of the Cornwall Polytechnic Society, a description was given of nine tanks, which had proved eminently useful during the late three dry summers on the Sussex property of Davies Gilbert, Esq., the President of the Society. As these tanks are cheaply and easily constructed, and not liable to decay like wooden vessels, and as rain enough falls on every house in England for the use of its inhabitants, no family would be deficient in good soft water who made a tank to *retain* it: and such tanks being paved over, take up no room.

The tanks at East Bourn vary in size: one of less than seven feet deep and wide has served two labourers' families for three years; whilst most of the springs in the neighbourhood were dry.

A tank 12 feet by 7 had supplied with water a large family and six horses. This was surrounded by only 4½ inch brick-work resting solid against the sides, in consequence of being smaller at the bottom than higher up; and the dome is constructed on the Egyptian plan, by projecting horizontally each row of materials one-third of their length beyond those below, and filling up the back with earth as it proceeded, to balance the weight of this projecting masonry.

At the East Bourn Workhouse for fourteen parishes, a tank has been made, 23 feet deep by 11 wide, of the roughest materials, being only flint stones, and though they require more mortar than if they had been regularly shaped, only 90 bushels of lime were allowed, including two coats of plaster, and the workmanship is executed like field walls at 10s. per 100 square feet; the only essential being, that *no* clay be used (which worms bore *through*), and that the lime or Parker's cement be good.

A current of air is said to promote the purity of water in tanks, and this is easily effected by the earthenware or other pipe which conveys the rain from the roof, being six or eight inches in diameter, and an opening left for the surplus water to run away; and where the prevailing winds do not blow soot and leaves *on* the house, the water remains good, even for drinking, without clearing out the rubbish more than once a year; but in some cases filtering by ascension may be found useful, and be effected by the water being delivered by the pipe at the bottom of a cask or other vessel from which it cannot escape till it has risen through the holes in a board covered with pebbles, sand, or powdered charcoal.

Upwards of twenty labourers' gardens have been watered by the rain which formerly injured the public road, and was therefore turned into a sink well, which sink well was enlarged and surrounded by 9-inch masonry, and the water is drawn up by a *cast-iron curb*. This water was used in planting potatoes, and occasioned good crops in 1835, when setts not watered failed. And, should the profitable mode of *stall-feeding* now practised at Armagh be happily extended to England, and fatting oxen be kept *in pairs not tied up under shelter*, it will be found that preserving in tanks the water which falls on the barns and stalls will amply supply them, whilst it prevents the rain washing away the strength of the manure when straw is spread in the open yard.

Ponds have been made with equal success, dug 4½ feet only below the surface, what is excavated being added to the sides, and covered one foot thick like a road with pebbles and good lime mortar. Such ponds are become general on the dry soil of the South Downs for the use of the large flocks of sheep: and had such ponds been made in Romney Marsh, &c., during the late dry years, the sheep would not have died in such numbers as materially raised the price of meat in London.—*Bath and Cheltenham Gazette.*

TUNNEL UNDER THE NIAGARA

Sir,—I perceive in some former Number of your Magazine, you have related an account of a proposed tunnel under the Ohio river at Cincinnati; your correspondent does not state that the bed of the river there, is a limestone rock, and the

huge building of immense thickness, and nine or eleven stories high in the water, stands on the rock, and all the stone to build it was procured from the bed of the river at low water. However, I am not going to relate any thing of the difficulties of that affair; my business is to suggest to your readers, and all others whom it may concern, that the greatest, best, and most magnificent tunnel in the world, would be in Canada, under the river Niagara, at the rapids of Fort Erie, opposite Buffalo in the United States; I say the best, and the easiest made, for the Niagara river there is narrowest, and its bottom is a flat, hard rock, which is a natural shield of itself, and below it a softer rock, which is easily cut. Captain B. Hall, in his "Travels" in America, has particularly described the strata a little lower down at the falls.

Now, if Brother Jonathan would agree to meet us half way, the thing, though of so great a magnitude, would be easier performed than any thing of the kind in any other part of the world. The only attention required would be to plug up with clay any fissures in the rock which might occur, and cement them over. No great depth is required; the water seems as shallow there as at the falls on the same rock. All Lake Erie is on a complete bed of rock, and so level that an anchor slides along hundreds of yards at a time without holding. The whole is particularly suitable for such a purpose; and whenever done (if ever done), your publication will have the honour of first pointing out to the public its true nature.

Your constant well-wisher,

A TRAVELLER.

Wilden, Sept. 30, 1836.

NEW PLAN FOR TAKING THE VOTES IN THE HOUSE OF COMMONS.

Sir,—In the House of Commons a considerable loss of time occurs at every division. To obviate this, I would propose that every Member should have a small knob at each hand, placed before him by his seat, with wires attached, to be continued (under the floor) to some convenient part of the House, there to be connected to small slides, in wood or metal, and coloured black and white, with the name of the Member engraved on each. By pressing either of the knobs when a division took place, the Member would raise either a black or white slide at the same time; and the motion might be so arranged as that a small ball should fall at the same time into two general receiving drawers—the black to denote the *noes*, and the white the *ayes*. The balls could be counted over in a few minutes, and the number given out to the House; and while the next business was going forward, the names of the different Members could be copied off the elevated slides by two clerks—one for the whites, the other for the blacks. After this, the slips could be pressed down by them to their places, leaving them ready for the next division, and so on. By this plan the Members would be saved all the trouble of going out into the lobby. Each Member should have a key to his knobs, so that when not in his place, his next neighbour might not be able to press it for him.

Yours, &c.

A. M. G.

Sept. 30, 1836.

MR. MACKINTOSH'S THIRD LECTURE ON THE ELECTRICAL THEORY OF THE UNIVERSE.

Mr. Mackintosh commenced by observing, that *expansion* and *contraction* of matter, to which he had in his first lecture traced all motion, were *two real forces*, or effects resulting from two real forces, and their conjoint action was fully competent to explain all natural phenomena. One of these forces, attraction, or the contraction of matter, had been recognised in all ages under the names of *weight*, *gravity*, &c. because its effects were visible. All men could see large masses of condensed or contracted matter falling to the earth, or approaching a centre; but the *expansive force* worked in an invisible way, not under the immediate cognisance of the senses, and therefore, although necessarily equal in power and extent with the *contractive force*, had not been so readily recognised. Its knowledge was approached by reason. Our senses were sufficient to inform us of the approach of a rain-drop towards the earth under the *contractive force*, but it was by inductive reasoning that we came to the knowledge that that rain-drop had receded from the earth under the *expansive force*—that the expanded matter had been condensed and contracted into a globular form like the earth in the upper or remote regions of the atmosphere; and that in this condensed form, being under the influence of the contractive force, it must of necessity be attracted towards the centre, from which it had receded, in an expanded form.

He wished here to correct a mistake into which he had fallen with respect to the original formation of comets. He still maintained that they were derived from the sun, but not in a mass; he considered that the matter of which they were formed issued from the sun in the most expanded form that can be conceived,—to be again contracted into globular masses in the remote regions of the system, in a manner analogous to the formation of a rain-drop, and as the condensation continued, so must they of necessity continue to approach the centre.

The *expansion* and *contraction* of matter, he continued, were the two pillars upon which the "electrical theory of the universe" was based; but it might be objected, that under the action of these two forces, matter ought to proceed *from* and *to* the centre in right lines, whereas, we know that the planets and satellites move in circular orbits. This, he said, was a fair and proper objection, and required an answer. In the first place, it must be borne in mind, that there are *two* forces. If their lines of action were diametrically opposed to each other, it was evident that the motion of bodies under each force would be retarded, so far, at least, as they interfered with each other; but if the two forces were not diametrically opposed, but inclined at a certain angle to each other, the opposing forces must necessarily produce a rotary or circular motion, causing the condensed matter or solid bodies to move in circular paths, and the expanded or fluid matter to move in vortices somewhat like those of the Cartesians. Now the orbits and axes of the sun and all the planets, he remarked, were thus inclined to the ecliptic and to each other; and in this was seen the wisdom of the Deity, who so arranged this great machine, that all the parts were fitted together so as to aid in working out his great design. He illustrated the action of two forces thus inclined to each other by a windmill; it was by the sails being inclined at a certain angle to the wind that the rotary or circular motion of the windmill was produced, which rotary motion of the windmill again imparts a circular motion to the fluid in which it revolves. He introduced some experiments and observations, tending to show that *all fluid matter* proceeded with a twisting or spiral motion, the ultimate cause of which he considered might be traced to the various inclinations of the orbits and axes of the sun and planets.

He further proceeded to show, that the hardest bodies in nature, such as quartz, diamond, &c. might, by galvanic agency, be converted into vapour so subtle as to be wholly invisible; whilst by the same galvanic agency, under a different modification of circumstances, hard and solid crystals may be formed, as is well known from the experiments of Mr. Crosse, of Broomfield:—thus the *expansion* and *contraction* of matter in the most eminent sense may be traced to galvanic agency,—galvanic and electrical agency being identical, or different modifications of the same power or *powers*. This theory was properly and appropriately entitled the "electrical theory of the universe." It appeared to him, that galvanic or electrical agency might be considered as the highest, most active, or ultimate source of motion in the physical world, of which we have any knowledge — next to the Deity himself, whose power is not a physical but a moral power, the power of mind over matter, and exercised in a manner which passes our limited comprehension, and is therefore not a fit object of our reasoning faculties. All that we can or ought to attempt, is to discover the physical agents employed by Him in carrying forward the various processes of nature, that thereby we may be enabled to extend the power and dominion of man over the material creation, and thus minister to the knowledge and happiness of the whole human race.

NOTES AND NOTICES.

The Supplement to the last Volume, containing Title, Table of Contents, Index, and Plate of Specimens of English Medallic Engraving, by Mr. Bate, will be published on the 1st of November next.

Mr. Howard's communication in our next.

Errata to Colonel Maceroni's paper "On the Electrical or Magnetic Theory of the Universe."—P. 21, col. 2, line 2 from the bottom, for "belonging to the globe—primary formations," read "belonging to the globes or primary formations."

P. 23, col. 1, line 15, for "fairly" read "faintly."

— 24, col. 1, line 22, for "with" read "within."

——, col. 2, line 8, for "alimentation" read "magnetisation."

——, col. 2, line 30, for "still" read "stellar."

——, line 40, for "minor pole" read major pole."

——, line 56, for "the communicating links," read "many of the."

P. 25, 1st col. line 25, for "declination of," read "declination and dip of."

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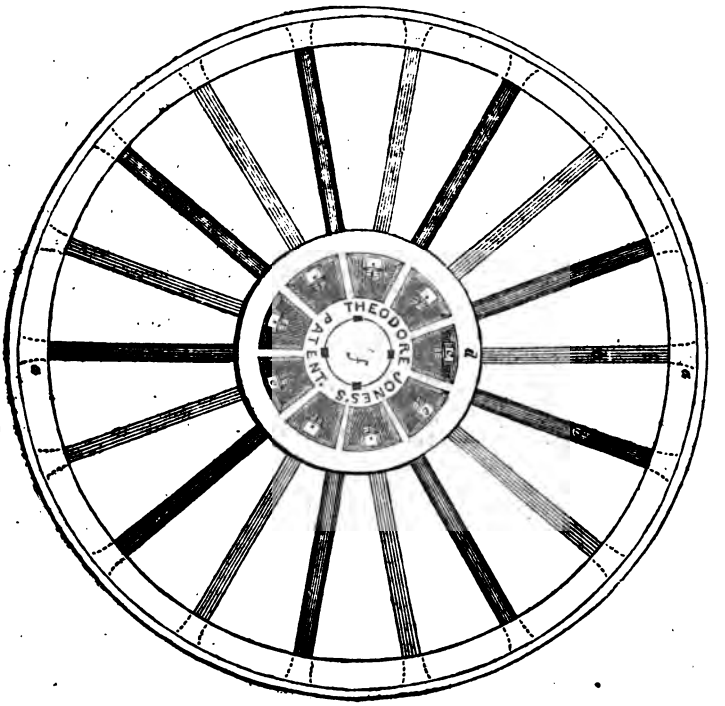
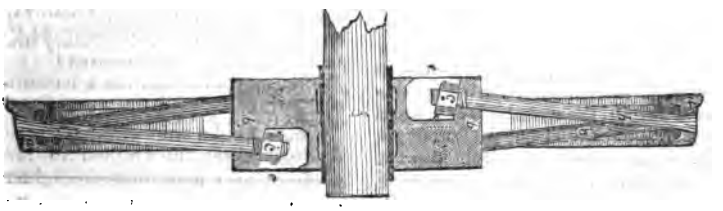
JONES'S PATENT WROUGHT-IRON WHEELS FOR LOCOMOTIVE-ENGINES AND RAILWAY-CARRIAGES.





JONES'S PATENT WROUGHT-IRON WHEELS FOR LOCOMOTIVE-ENGINES AND RAILWAY CARRIAGES.

Sir,—It is an unfortunate, though well observed fact, that out of every ten American patents, nine are for some impracticable or useless process, or for some slight modification of previous English inventions.

Any person acquainted with the patent wrought-iron wheel of Messrs. Theodore Jones and Co., will at once perceive it to have been the prototype of the cast-iron wheel patented by Mr. Arundius Tiers, of Pennsylvania: a description of which is copied into your 683rd Number from the *Franklin Journal* of July last. It is really curious to observe the various shapes into which an useful invention is tortured by would-be inventors or improvers; such has been the fate of Mr. Jones's wheel, which has been tried in almost every possible shape, in this and other countries, by ringing the changes upon wrought and cast-iron, &c., but carefully avoiding the particular mode of construction patented by its ingenious inventor, which is alone calculated to realise all the advantages pertaining to this particular form of wheel. There are several reasons why the mode of construction adopted by Mr. Arundius Tiers should not succeed in practice, and one of them has been very ably pointed out by a previous improver of locomotive-engine wheels, whose patent was reported in the *Franklin Journal* for November, 1835, inserted at page 325 of your 24th volume.

"It is well known," says Mr. Baldwin (the patentee), "to engineers upon railroads, that, in running upon iron tracks, the wrought tire forming the tread of the wheel, when the wheel is altogether of iron, is gradually stretched and becomes loose."

This is true enough, and the evil consequences of this effect being wholly unprovided for in the wheel of Mr. Tiers, should the spokes hold out long enough, he will most assuredly find the iron tire F E, page 398, will soon become loose, and prove exceedingly troublesome. From the very unfavourable position in which the metal is placed, however, there is great probability that other parts of the wheel will fail before this effect takes place. Valuable as is the principle of the iron suspension wheels, no portion of their advantages will be obtained by the method of construction attempted by Mr. Tiers.

Two of the greatest difficulties consequent upon the introduction of locomotives, were in obtaining *boilers* and *wheels* suited to this particular purpose. Considerable improvement, the result of long and expensive experience, has been effected in the manufacture of boilers; nevertheless, *a good and durable boiler* is to this day a desideratum in this particular application of steam power.

Several different forms of wheels, and various modes of construction, have been tried; but none has yet been found in every way adapted to this kind of work, with the exception of the patent wrought-iron wheels of Messrs. Jones and Co., which, from some long and carefully conducted experiments on the Manchester and Liverpool Railway, appear to meet every exigency, and to obviate all the difficulties hitherto experienced in this branch of locomotive economy.

The great superiority of the iron wheels for transporting heavy weights on common roads, has long since been satisfactorily established; suffice it to say, that their superiority is fully maintained upon railroads, a species of work for which they are especially adapted.

Fig. 1 is a front view, and fig. 2 a section of one of Messrs. Theodore Jones and Co.'s patent wheels for locomotive-engines. The rim *a a* is of the best malleable iron, rolled into the form shown by the section. The spokes *b b* are conical at the head, to give them a firm bearing from the outer edge of the rim, and are tapped at the other end to receive the nuts *c c*, by which they are drawn up tight, and the nave *d* suspended in the centre of the wheel. Split keys *e e* pass through a slit in the spokes, and through a hole in the nuts, to prevent them from turning and thereby loosening the spokes: *f* is the axle, to which the wheel is keyed up.

Some of the more striking advantages of this wheel, as applied to railway-engines, are: first, they are lighter than any other wheel of equal strength, or they are stronger than any other wheel of equal weight, in consequence of the metal being employed in the most favourable manner, i. e. *in a state of tension*, in which, it is almost needless to say, it is capable of enduring the greatest strain

without injury. Secondly, the tires of these wheels can *never become loose*. Thirdly, they are less destructive of the rails and of their own tire than any other wheels, in consequence of their natural elasticity greatly diminishing the rigidity of the stroke upon the rails, thereby relieving them from that intense dead weight, which, in *cast-iron* wheels of the ordinary kind, travelling with great velocity, occasions so much wear and tear, both of the rails and wheels. Fourthly, the spokes, as well as the rim, being wholly made of *wrought-iron*, are not near so liable to fracture as *cast-iron*, while they are equally free from all risk of taking fire like wood. Finally, I may notice the great facility with which one or more spokes may be replaced or exchanged without removing the wheel from the engine, so as to occasion but little interruption to the running, thereby enabling a minimum number of engines to do any given quantity of work.

In some recent experiments, conducted with great nicety and attention, the difference of wear and tear between these and the ordinary wheels, was found to be in the proportion of *one* to *three*. The actual wear upon Messrs. Jones and Co.'s wheels was found to be only $\frac{1}{16}$th of an inch, while that of other wheels was $\frac{3}{16}$th of an inch—the distance travelled being fifteen thousand miles!

Much has been said and written in favour of *spring wheels*, and several different modes of constructing such wheels have been proposed—one or two have been patented. Jones's wheel allows full play to the *natural elasticity of the metal*, and, in my humble opinion, this is the utmost SPRING that can ever be advantageously employed.

I remain, Sir,
Yours respectfully,
W. BADDELEY.

London, Oct. 5, 1836.

OBSERVATIONS ON MR. EXLEY'S NEW THEORY OF PHYSICS. BY MR. BENJAMIN CHEVERTON.

(Continued from p. 431, vol. xxv.)

Power or force cannot be seen in itself, but only in its results, or as a cause in its effects. We lose, therefore, all the vivid impressions of matter, which hitherto we have received from its supposed solidity and extension, and which we have been accustomed to consider as representing, or even, we may say, as realising its essential nature—we are to rank those qualities along with properties, which merely indicate the capability of matter, under some or all circumstances, as the case may be, to act as the cause *by* which the senses are effected, but *of* which we are in nowise cognisant—and we are to accept in return a power, in itself occult and imperceptible, and of which, from the very nature of the case, it is impossible we can be conscious of any direct apprehension. We are thus left entirely in the dark concerning matter; we have no experience, no knowledge of it whatever, save only of its effects, as a force operating upon ourselves, whereby we have the *perception of material qualities*, but which we are forbid to consider, to have any exemplar inherent in bodies themselves. Surely, by thus turning solidity and extension over to our perceptions, we have gone far to materialise mind and to spiritualise matter; at least, we have quite succeeded in confounding and upsetting those long-established categories of being, and in rendering their distinctions vain and idle, by taking away entirely the ground on which they rest.

If matter is known to us, as Mr. Exley says, "only by the forces which it exerts," producing within us the impressions of solidity and extension, just in the same manner as we obtain a knowledge of it in other particulars, by its producing the impressions of colour, heat, sound, &c., how can we predicate any thing of it beyond what we do in the latter cases, namely, of its being an agency acting under certain conditions, and regulated by certain laws? These impressions are all by which we can discern of it, and these arrangements and laws are all we can discover of it—impressions *on* what?—laws *of* what? All that can be said with any certainty, is, that the impressions belong to a sentient and active existence, and that the laws belong to an active existence simply. Now this distinction, resting only upon negation, implies no *real* difference, but one only of order and degree. Negation, abstractedly considered, warrants no inference—it carries us no further than the fact. To derive from it a proof of essential difference, we must first connect with it the proposition, that the attributes

which are absent are incompatible with the essence of the given substance; and then, if proved, it necessarily follows, that where those attributes are present, the substance to which it belongs is essentially different from the other in question. But how, in the present case, is it possible for us to determine that the power of thinking contravenes the essence or substance of matter, seeing that by the alleged description of it, it is utterly unknown to us, except as an upholder of powers. We had something to fall back upon when we could make extension and solidity to be of the very essence of matter—we had something on which to rest an argument of incongruity—we had something to support our assumption of so intimate a knowledge, to a certain extent, of the essence of the material substance, that we could confidently pronounce of the spiritual attributes that they could not attach to it, and that they must necessarily belong to another very different substance, although we were unacquainted in any degree with the nature of that other substance—the knowledge of only one, being quite sufficient to sustain the validity of the argument: but now we are denied the data whence arose the inference of dissimilarity—now we are deprived of all criteria whereby we may adjudge a real difference to exist between the spiritual and material essences, for it appears that we are enveloped in darkness and ignorance as much in respect to one as the other. Matter being considered to be simply an upholder of power. What then is to bar the conclusion that all the powers which exist in nature co-exist therein?—what test remains to us whereby we may discriminate, exclude, and assign?

Before we take a further review of the consequences which are deducible from Mr. Exley's physical theory, it ought to be observed, that they inevitably flow, not alone from his theory, but from any other which recognises matter only in its powers to affect the mind. Thus the theory of Boscovich will lead to the same results. Indeed, it would be easy to prove the same of all atomic theories, so far as they endow the atoms with forces, and from thence make all quality and action spring. The physical philosopher who talks of impenetrability as arising from force, sees not the conclusions to which the metaphysical philosopher can drive him. The metaphysicians, indeed, are often equally blind. They sometimes inadvertently, and in a manner inconsistent with their other principles, descant, without the least qualification, on the impossibility of our acquiring a knowledge of the essence of things, unmindful herein, that they advance a proposition which is pregnant with consequences they would not willingly admit. But wherever the doctrine is found, whether openly avowed, necessarily implied, or unwittingly admitted, that matter in itself or in its nature is not in any manner cognisable, but that it makes itself known to us in the powers of its operations, of only the effects of which we are conscious, the conclusions which have been already drawn, and which are yet to be deduced, ought, if any regard be paid to consistency, to be unhesitatingly received, and the views and feelings to which they give birth ought to be cheerfully adopted. It is not the object of this paper to prove the truth of this metaphysical doctrine, but to take it for granted, or rather to take it as involved in Mr. Exley's physical theory, and in many other theories and statements besides, and thence to educe the consequences. If the reader does not admit this doctrine, he will be unmoved by the conclusions to which it leads, however startling they may appear to others, but then he ought to bethink himself how he can disprove it. If prejudice be the only obstacle to its reception, if the blazonry of authority be thought to be the one thing needful, the former will be abated, whilst the latter will be supplied by the following remarkable quotations from the recent Bridgewater treatise by Dr. Roget:—"The only distinct notions we are capable of forming respecting matter, are, that it consists of certain powers of attraction and repulsion occupying certain portions of space, and capable of moving in space; and that its parts thereby assume different relative positions or configurations;" and again—"It is not difficult to prove that the objects of perception are mere creations of the mind, suggested, probably instinctively, by the accompanying sensations, but having no real resemblance or correspondence either with the impressions themselves or the agencies which produce them; for many are the instances in which our actual perceptions are widely different from the truth, and have

no external prototype in nature." Let me also observe, in further explanation, that the conclusions to which we are led by the doctrine in question, do not tend to materialism, for they affect only the question of a *specific and determinate* knowledge of the existence of two distinct substances—matter and spirit. Besides, take even the extreme supposition, and assume it to be a conclusion warranted by the doctrine, but which it is not, that the substance which upholds the powers of matter upholds all the other powers and attributes which exist, still it would not amount to materialism; for matter being by this doctrine deprived of the gross qualities wherein its nature was supposed to exist, becomes an unknown entity, like unto spirit, so that it may with as much propriety be affirmed that matter is spirit, as that spirit is matter. The terms, matter and material powers, and spirit and spiritual powers, must therefore generally be understood in the following remarks, as distinctive merely of the difference in respect to the powers exhibited by the unknown causes, and not as conveying any intimation of their supposed nature. In returning from this digression, let us keep these explanations in mind.

If solidity and extension afford us no insight into the nature of matter, if they are merely the effects of power, or, in other words, are only the affections of our own minds—we are cut off from every argument grounded on the natural necessity of things, which may enable us to prove that the powers to think and to will, and the powers to attract and to repel, *cannot* subsist in the same essence. That the spiritual powers are incongruous with solidity and extension, considered as external essences, may be tenable; but, considered as sentient impressions, as effects whose causes stand on the 'vantage ground of being powers themselves, and active powers too, how are we prepared to deny that the material and spiritual attributes comprised thus in the same category of power, co-equal in order and kind, though inferior in value and degree, cannot inhere in and be supported by the same substance? Deprived by the doctrine in question of a knowledge of the nature of external causes, and conversant only with their effects upon ourselves, the scale of created being, for aught it is possible that we can discern to the contrary, may proceed, not by differences in the substratum, but by varieties in the powers which the great Giver of power may, in classes of gradation, endow created existences. In the absence of a knowledge, in any degree, of the essence of things, we cannot conclude, from a difference simply in the adjuncts, the endowments, the powers, that a necessity thence arises of the existence of essentially different substances in which such different powers may inhere; for such necessary relation can be perceived only in the light of an insight, in some degree, into the nature of bodies, but which by the doctrine is wholly hidden from our view. Besides, such an argument destroys itself by proving too much—it would prove the existence of as many different substances as there are powers, and it would destroy the unity of our spiritual being, by enforcing the necessity of the existence of different substances, to support respectively the different powers of thinking, feeling, and willing. The powers characteristic of intelligent and inorganic nature, however different—and the difference certainly is immense in respect simply to worth and dignity—may with as good reason be supposed to unite in, and be comprehended by, the self-same substance, as that the respective powers, though different among themselves, and notwithstanding the immensity of that difference, may be allowed, as they confessedly are, to be united in, and comprehended by, their alleged respective essences.

We cannot affirm, then, that there is a natural necessity for the existence of different substances or essences, for this doctrine of powers cuts us off from a knowledge of the nature of things, on which alone such a proposition could be founded; neither can we argue for this necessity, as an *à priori* truth, for herein we are, if possible, yet further removed from all intelligence on the subject. Knowledge is not to be acquired by us after this manner, for it falls not to our lot to be enlightened as to the discovery of natural truths, either by intuition or inspiration; only the vain babble of verbal metaphysical subtleties can be brought to bear on the point. The Creator can alone perceive this necessity, if such in he nature of things exists. But why should this be said? Is it not in the exercise of his paramount will and power, that the nature or constitution of things is established? Nothing is prior

thereto; nothing is of necessity but what he ordains. And who, in the presumptuous promptings of intellectual pride, shall say, that in the sovereign exercise of those attributes he has not caused the material and spiritual powers to be upheld by the same substance? If uninstructed on this point by the teachings of nature, the unassisted reason of man must lie prostrate before the height of such an exalted theme.

The only appearance, then, of an argument, by which we may contend for the distinct and discrete nature of the unknown essences, as respectively supporting the spiritual and material powers, must rest simply on the *probability*, that only different substances could have been endowed with powers so very different. This argument on the probability, like the similar one on the necessity of the case, proves too much. The application being the same, need not be repeated. But failing to attain unto certainty on this subject, it is scarcely commensurate with the importance which has been attached to it, to discuss the arguments which touch merely on its probabilities. If, however, it can be shown that even on this head, from the insufficiency of data, nothing can be concluded that would justify the slightest confidence of belief, and if, on the supposition of the truth of the doctrine in question, we can only wander in pathless fields of conjecture, it would be wise to dismiss from our thoughts a subject, which to attempt to determine either way, were only an idle exercise of the imagination. It were a "consummation devoutly to be wished," and which the establishment of this doctrine would hasten, were we to banish from controversy a subject which, being proved to lie beyond the reach of our faculties to investigate, ought not even to excite curiosity, but, above all things, ought not to raise those angry contentions which, unhappily, have so frequently accompanied its discussion. Indeed, disquisitions like the present have no other utility, I conceive, than their tendency, by disclosing to us the limited extent of our reasoning powers, to allay those animosities, to call us off from the pursuit of such sterile inquiries, and to direct the application of our energies to those more useful subjects which come, in some degree at least, within our grasp. Fully impressed with these views, I proceed to shew, that even the probability of the existence of different essences to uphold different powers, cannot be supported by arguments founded on any means of knowledge which this doctrine leaves in our possession. In the accomplishment of this object, the question itself is not attempted to be decided, nor any decision of it to be influenced in one way more than another. Nothing is determined, nothing is sought to be established—but our total incapacity to grapple with the subject, either affirmatively or negatively. Thus much it has been thought proper to say in order to avoid misapprehension.

The supposition, though merely one of probability, that very different powers imply different *substrata*, is not only unsupported by analogy, but is contrary thereto, or rather to the tenor of facts which are universally conceded. Thus, all the difference that exists between action and passion exists between the powers of willing and perceiving, and yet they are both upheld by the same being. And is the difference unimportant between the powers of attraction and repulsion, or between these and the endowments of vitality, and yet they also are upheld by the same being? But is there in reality any very great difference between the spiritual and material powers, except as the latter is contrasted with the highest developments of the former, which, be it observed, includes a difference in respect to degree as well as to kind. There is no immense gulf of separation between the lowest and the highest development respectively, of the spiritual and material powers. The astonishing energies and resources which distinguish vitality in reparation after injuries, in reproduction after mutilations, and in the generation of kinds, stand not far distant from the powers manifested in the instincts of sentient existences. It would not, indeed, be a bold assertion to say, that in the highest instances they take a more exalted rank in the order of being than the instinctive powers in their lowest instances. Just as in the analogous cases of the different types or forms in animated nature, where in the highest steps of the lower series, the living structure or the living functions, being in the fullest development of their kind, entitle their subject to a more advanced place in the general scale of creation than they do in the lowest steps of the higher series, where they exist in the rudimental stage. Should it be said that the instinctive fa-

culties are not to be classed with the spiritual powers, it may then be asserted still more confidently, that the attributes of matter, as exemplified in instinct, are yet less distantly removed from the attributes of spirit. Instinct, as illustrated in its highest grade, even excels the more ordinary acts of reason, though the latter, as being the more excellent endowment, in general excels the former. I know not how far in the scale of creatures the powers which imply a spiritual or an immaterial essence are supposed to descend, but wherever we stop, it will be difficult to prove that those immediately below are greatly removed from them; and if we continue to descend, we shall find that they gradually vanish from observation, and that in their lowest stages, if placed in comparison with the more important of the mere vital endowments—though attributes or powers of matter these are supposed to be—they are not to be distinguished as possessing superior or even equal excellence. If, on the other hand, we determine not to go beyond the bounds of human nature for the exemplification of spiritual powers, we shall find it still more difficult to prove, that the faculties possessed by the highest of the inferior creatures are separated from them by any very wide difference, or, at any rate, that the difference is so extreme as is implied by making them the endowments of distinct essences—the material and the immaterial. In reference, indeed, to those faculties which they enjoy in common with ourselves, the conclusion is inevitable that whatever essence supports them in the one case, supports them in the other. If it be spirit, where does its manifestation end? Descending in the scale of animated nature, have inquirers ever arrived at a boundary, possessing such a breadth of demarcation as is imperatively demanded, if we would pause to distinguish and assign the spiritual and the material—at a boundary so distinct and definite, that, as the case requires, he who runs shall not overlook it?

Let us now contemplate the spiritual and material powers in their relation of activity, but restricted to its manifestation in mobility, and we shall observe some startling analogies. Volition implies action; it implies force; it implies motion. The vital powers, as also the more subordinate material powers of attraction and repulsion, imply the same in equal potentiality. Volition is, in its action, as much clogged with the condition of time as are the other powers. Volition can oppose, overrule, and modify the action of the more subordinate of the material powers. The vital powers are possessed of equal authority to do the same. These several powers, material and spiritual, if considered in the common aspect of a force, are really in nowise different. But a distinction must somewhere necessarily exist—and, by the way, this necessity affords an argument for the truth that is involved in the proposition, which assigns that distinction by giving to volition the character of free agency. The attribute of activity, simply considered, is indeed common to the spiritual and material powers; but, doubtless, a ground of distinction highly characteristic is to be found in the fact, that whilst the activity of the one is voluntary and has reference to final causes, that of the other is necessitated and has connexion only with efficient causes. Still the mere activity which the material powers imply, is so striking and so analogous to spiritual power, that it is considered by philosophers in general to be incompatible with matter, on the ground of its assumed inertness. They think that such activity is in reality the attribute solely of spirit, although it apparently belongs to matter; and, accordingly, ever since the days of Descartes, and following him therein, they have ascribed the activity which is every where manifest in the operations of nature to the exertions of the Divine power. Contending for the absolute passiveness of matter, and not choosing with Kepler to tenant it with a monstrous spiritual agency, they have made it the abode of the Divine presence and power, that is to say, they have chosen to recognise in its operations the *doings* rather than the instituted *works* of the Deity. This is a strange doctrine, and removes, as I have shown in my former paper, all real difference between these philosophers and the idealists; but it shows very clearly, that in thinking they were obliged to resort to it (for surely the good sense of men in general is against it); they must have been forcibly impressed with the resemblance there is in this particular, between material and spiritual powers. It was to avoid this conclusion, by identifying them in the character of a spiritual attribute, that the doctrine was invented

Let, however, the difference between these powers be what it may, it is not greater than what exists among themselves in their respective classes, and which do not confessedly prevent their being upheld by the same substance. What can be more unlike than perception and volition, or more dissimilar than the vital powers and the mere mechanical powers of matter, viz. the forces of attraction and repulsion? Is not the diversity in both these cases as great, to say the least, as between the spiritual and the vital powers? Yet none contend that the passiveness which distinguishes the faculties of perception and sensation, and the activity which marks that of volition, are, on account of their dissimilarity, characteristic of the attributes of different substances. No one contends that those vital powers, which, as if from design, assort, combine, and arrange, in opposition to, or in modification of, chemical and mechanical forces, and after an order and manner so consecutive and collocative, that the results *apparently* are as much indicative of an attention to final causes, as if they emanated from intelligence and volition — no one, I say, imagines that these mysterious endowments inhere in a substance different from, though in union with, that which supports the mere mechanical forces, which, obeying a blind necessity, act irrespective of end or purpose. The incongruity, however, has not passed unobserved, and the truth is, that the restlessness of man's imagination would not have allowed him to remain content with two substances, if by any possibility of devising a third, he could have relieved himself of the difficulty of consistently apportioning among them so many different powers. But, unfortunately, it has been found, that even to produce the poor variety of material and immaterial substance, is not an easy task. In the grossness and straitness of our conceptions, we fix on solidity and extension as best suited to characterise the substance of matter. Confined to what passes within the mind, for a knowledge of things without, we take the effect and make of it the cause; we take the affections of a sentient being, and constitute thereof an insentient agent. In quest of something by which we may pourtray to our conceptions this substance of matter, and limited in our range to the impressions which it produces, we throw back upon the causes their own effects, and are reduced to the necessity of taking the mental objects of our consciousness, wherewith to embody this otherwise unimaginable entity in a form for contemplation. But another substance being required to support the intellectual powers, we, in the extremity and indigence of our resources, are obliged to be satisfied with a negation, with the notion of a something, of which the utmost we can say is, that it is not solid and extended — that it is *immaterial*. The illusive importance of a name, however, it possesses in its designation of "spirit." The orientalists, not satisfied with a name and a negation, and passing by solidity, selected one of the more subtle sensations wherein to embody a conception of spirit — and fire was its etherial essence. But this opinion is obsolete. There are those, however, in the present day who are satisfied with a name without a negation, or any thing else, and accordingly we have a trio of entities—matter, soul, and spirit. How the third is to be discriminated, except by its name, it would be difficult to say. Do not these unprofitable and unfounded speculations expose the utter helplessness of our ignorance? They exhibit our blind and impotent, gropings after we know not what, and teach us, that substance or essence is placed beyond our comprehension. We see, on the one hand, the ill-success and hopelessness of our efforts to obtain, though with the help of a negation, any allowable idea of more than two distinct substances; and, on the other hand, the insufficiency of these two to support the many powers, so importantly different, which nature exhibits. The conclusion from the preceding considerations generally, is, that we should not attempt to adjust and reconcile substances and powers, that an argument for a difference between the former cannot rest on differences observed between the latter, and that our distinctions of orders and kinds should not reach unto essences, but be confined to their attributes, with which only we are conversant.

Let me not be misunderstood—it is not intended so to argue this subject as to establish it as an indisputable proposition, that the spiritual and material powers are upheld by one common substance, or even to insinuate that this opinion is with some probability to be inferred from the

preceding considerations; for this would be quite contrary to the spirit of the previous reasoning, which goes to show, that nothing is determinable herein but our own ignorance; that admitting the truth of the doctrine in question, we are not in possession of the slightest clue whereby to unravel the mystery; and that to assume to decide the question in any way, would ill comport with that humble tone of inquiry, and that limitation of our researches, which the inductive philosophy recognises. Neither let it be understood that these views countenance in the slightest degree the doctrines of the materialists, for, as I have before intimated, they, by assuming along with their opponents a knowledge of the nature of matter, furnish the very ground on which rest the arguments for their own discomfiture. But, on the other hand, it is strenuously contended, and for precisely the same reason as before—the limited extent of our discerning faculties—that the contrary proposition cannot be supported; that on this, the more orthodox side, dogmatism is equally to be deprecated, and that it would betoken true wisdom and a becoming humility, if all parties would abandon the high categorical pretensions, in which, seduced by the pride of reason, they are equally prone to indulge, and mutually and ingenuously confess that knowledge of this kind is too mighty for the mind of man. Intellectual arrogance is fostered, whilst the understanding is benighted, in the pursuit of these dark and hidden themes; but orthodoxy, on the one hand, and heterodoxy on the other, take occasion of these suitable because indeterminable points, to raise the insignia of party, and to erect their equally presumptuous, unphilosophical, and unimportant systems. Better would it be, and it is to this end the preceding considerations point, to acknowledge, with the doctrine in question, that matter is known to us only in its powers, and to classify the different orders of being by the appreciable distinctions recognised among their powers, rather than by differences, which are as little to be comprehended as the essences to which they relate. Let our distinctions be such as may be universally perceived and understood; let them refer to matters of observation and experience; let us have the wisdom to be wise enough, and debateable ground will not more belong to ntology than to natural history. Let then the terms matter and spirit, if we must continue to employ them, be taken to mark merely a distinction in regard to certain powers and operations, and not an inherent difference in their ultimate causes; for though in the real but inaccessible truth of things, it may be that such a difference exists, yet information in respect to it being utterly impossible, it would be unphilosophical to found distinctions on ignorance, and to base classification on conjectures.

(To be concluded in our next.)

ANOTHER DISCOVERER OF A MODE OF PROPELLING AND DIRECTING BALLOONS.

An Italian gentleman, Signor Leonardo Andervolti, of Spilinbergo, in the Friuli, informs us that he has invented an aerial locomotive balloon, capable of propulsion and direction at pleasure, with safety and precision, either with or against the wind. He has constructed, he says, a working model of this machine, with which he has actually traversed the air in his own country. He offers, if a certain sum of money be guaranteed to him in the event of his succeeding (of which he entertains no doubts,) to fly over to England in his balloon!—Or that he will at his own expense construct a balloon here, which shall be able to keep up a regular traffic between any two points at a reasonable distance from each other, with even greater rapidity than any steam-boat or coach! The Signor does not ask a farthing until he has performed the foregoing conditions; but as his mechanism is so simple, that as soon as constructed it would be copied, and he might thereby lose the fruits of his ingenuity, he requires that a certain sum should be guaranteed him before doing so, either by a company or individuals, to whom he would assign his invention secured by patent. Signor Andervolti has left his address at our office.

The Signor speaks very fair; and as he asks nothing until he fulfils the conditions above stated, there could be no risk incurred were a number of individuals to subscribe for a hundred pounds or so each, to secure so grand an invention. Of the thing itself we do not profess to give an opinion,—we know no more of it than what is stated above.

A MECHANICAL METHOD OF TEACHING AND EXAMINING MUSIC BY THE USE OF A SLIDING-RULE. BY MR. WILLIAM ANDREWS.

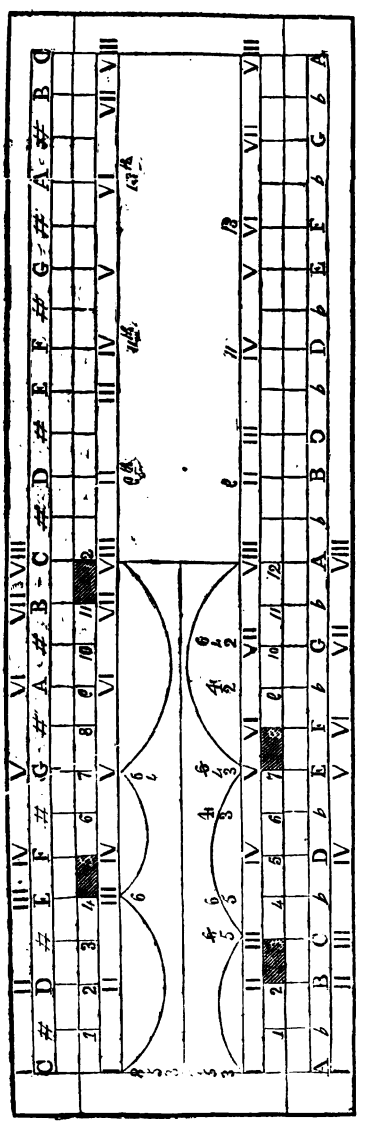


Fig. 1.

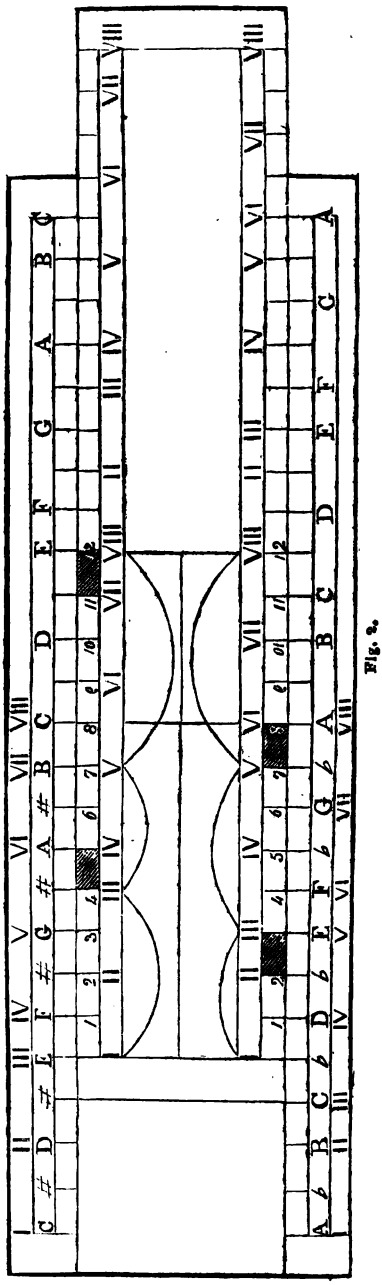


Fig. 2.

Introduction.—It will be observed I have used the common method of counting the intervals of the diatonic scale, viz. by using Roman figures; and the chromatic scale is marked with small common figures, counting the interval from the first note named (but not included) to the next note required.

Of Keys.—The rule when not in use, *i. e.* the slide even with the ends of the stock (see fig. 1,) represents the only natural keys, viz. the upper part of the stock and slide show C not to require any sharps, because I. on the slide is opposite C on the stock; II. is opposite D; III. opposite E; IV. opposite F; V. opposite G; VI. opposite A; VII. opposite B; and VIII. opposite C.

At the same time, I. on the (lower part of the) slide is opposite A on the lower part of the stock; II. opposite B; III. opposite C, and so on to VIII. opposite A; likewise A to be the relative minor key to C major. To find how many sharps or flats are required, and on which notes in any proposed key, you have only to set I. on the slide to the proposed key note.

See fig. 2, where E major key is proposed, you will find I. on the slide under E; II. under F *sharp*; III. under G *sharp*; IV. under A; V. under B; VI. under C *sharp*; VII. under D *sharp*; and VIII. under E, the octave. Showing E major key requires four sharps; viz. F *sharp*, G *sharp*, C *sharp*, and D *sharp*; likewise the chords to the key note are seen at sight; suppose $\frac{5}{3}$ then opposite III. is G *sharp*, and opposite V. is B;—if $\frac{6}{4}$, then opposite IV. is A, and opposite VI. is C *sharp*.

Without removing the slide, it is seen that D *flat* is the relative minor, and requires five flats, viz. D *flat*, E *flat*, G *flat*, A *flat*, and B *flat*, when ascending; because, when a minor ascends to the octave, the semi-tone shown between the V. and VI. is removed to between the VII. and VIII; but in descending the semi-tones fall in their natural places.

Intervals, either diatonic or chromatic, are read off similar to the chords described above. In fig. 1, from C to A is a VI., or nine semi-tones.

Inversion is easily explained, as, for instance, see fig. 1: suppose a flat be found under E in the base—query, the thorough bass and its chords? It will be seen under III. on the slide is a flat, which being under E on the stock, shows C to be the thorough bass note, E the III., and G. the V., &c. &c.

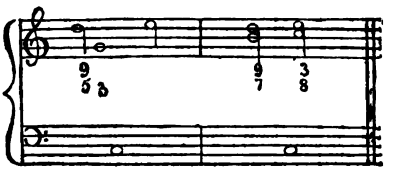
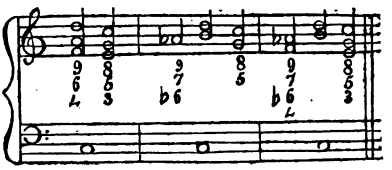
The chords of the seventh and its inventions are as easily applied.

Thorough bass and fundamental bass are explained by a similar process.

Chords by supposition, as the ninth, eleventh, and thirteenth are as easily managed, since the general use of the rule are to show the chords at sight, by having a figured base, or having a bass and an accompaniment to find the proper figures.

On the stock of the rule under the slide are figures (not shown in the drawings), showing the proper accompaniment to each individual note in the octave, either major or minor, ascending or descending.

An example or two by way of application:—

Fictitious Eleventh.

Fictitious Thirteenth.

In fig. 1, all this is explained without altering the slide.

The curve lines from I. to III., and III. to V., denote that the chord is from the tonic. On my rule I have three different coloured curves—the first denotes, as in fig. 1, the chord of the tonic; the second (not on the drawing) denotes the chord is from the subdominant; the third, the chord from the dominant.

W. ANDREWS.

Near Ivinghoe, Bucks, Oct. 1, 1836.

MR. HOWARD AND MR. SYMINGTON.

Sir,—I observe that Mr. Symington has not stated as I requested, "without reserve, *where* and in *what manner*" my method of condensation had been in practice forty years. Why has he omitted to answer the latter part of the question? He taxes me with being out of humour, and with using towards him an authoritative tone. Suppose it to be so (which I do not however admit), does he not give me cause for it?

To bring the correspondence in your Journal on this subject nearer to an end, allow me to direct the attention of your readers, and more particularly of Mr. Symington himself, to the following extract from his original communication in your 677th Number, for I have not yet had leisure to inspect his specification:—"*By cooling down the water in the hot well to the temperature of the external water, by means of a pipe so placed outside the vessel, as to receive the direct action of the water, in order that condensation might be effected by injecting again and again a portion of the same water.*" Mr. Symington further refers in that communication to the superiority of this plan of condensation by *injection*, as a new method over that by external cold applied to the steam itself. Now this is precisely, and, I aver, beyond all cavil, the same process of condensation as that previously invented and carried into effect by myself, and of which Mr. Symington *ought*, at least, not to have been ignorant. There is this difference *only in the detail*, that he proposes to lead the cooling pipe outside the ship; whereas, I lead it through the cold water within the ship. He may deem this an improvement in the arrangement—I beg to differ with him; but an improvement in the effect, I know by practice it can hardly be, for my plan accomplishes all that can be desired. However, he is welcome to it, apart from the appropriation of my invention, if *in itself* it be found new or advantageous.

Does not Mr. Symington perceive that his repeated reference to the *drawings* accompanying our specifications is admitting the weakness of his cause? My drawing is that of an *arrangement* by which the *invention* is rendered practically efficient; and the pumps there shown, by which the refrigerating pipe is supplied and the injection effected, present an advantage over the (I admit rather more simple,) plan of making use of the air-pump and hot cistern, as usual, in so far as the power required to work this air-pump (say 1 lb. per square inch on the steam piston,) is nearly all saved. But it happens that the process under *this* more simple form has been practised, and is at work in the Vesta steam-packet, now running daily to or from London, and Southend, and Sheerness. Perhaps in the next vessel, or may be on land, I may think proper again to alter the detail. But the principle or method remaining the same, and having shown in my specification, and since publicly carried into effect, a perfectly efficient arrangement, which I thought the best at the time of enrolment (and I still think it so on the whole), I appeal to you, Mr. Editor, from your knowledge of patent business, if under such circumstances (putting it merely as a general question,) I am not entitled to vary the details, and, at the same time, to prevent others from appropriating the invention itself by doing so; and further, if this be not the true reading of the patent law, whether, in your opinion, any patent whatever for a new invention can be worth one farthing?*

I may just add (Mr. Symington having alluded to the subject in his communication before referred to), that by means of a simple contrivance (in the Vesta) I have obviated the liability to accident arising from the condenser or the air-pump, in the common mode of withdrawing the injection water by it, becoming choked with water under the unequal motion of the engines in a heavy sea.

I am, Sir,
Your most obedient servant,
THOMAS HOWARD.

7, Tokenhouse Yard, Oct. 18, 1836.

MANUMOTIVE-CARRIAGES.

Sir,—By the extract in your last Number from a Dublin paper, we learn that a whitesmith of Enniscorthy is employed, as several other persons at this time are, in constructing a manumotive-carriage. In the present instance the vehicle "is

* To the question as put by Mr. Howard, in the "general," we have no hesitation in giving our answer in the affirmative. He gives a very correct view of the law on the subject. How far it determines the case in hand we presume not to say.—ED. M.M.

propelled by an iron handle, which the guide moves to and fro with the right hand."

One would think it was almost impossible to hit upon any scheme for this purpose possessing much novelty, so many and so various are the plans that have been tried. When *velocipedes* were so much the rage in London a few years since, much ingenuity was exercised to produce manumotive-carriages in which the softer sex might ride; but without success, and since that time this has been the favourite hobby of many individuals. It is unfortunately a fact, that too many persons are apt to imagine, that the success of their machine depends upon the quantity and complexity of the mechanism employed, and this mistake generally proves fatal to their success.

When discussing this matter in a previous Number (635), I stated that the simplest, and therefore of necessity the best way of constructing manumotive-carriages, was to "fix a spur-wheel on the axle of the propelling-wheels, and drive them by a pinion duly proportioned to the inverse quantities of time and power. The man's labour applied to the pinion by means of a winch-handle, would produce all the effect to be derived from such a source, and more than could possibly be obtained by any more complicated train of mechanism."

By applying the manual power to two cranks placed on the axle of the pinion, but opposite to each other, working the one with the right hand and the other with the left, the greatest possible effect would be produced. The guiding could easily be managed with the feet. By a machine so formed, favoured with all the advantages of the best workmanship, a person might propel himself at a tolerable good speed; but for any great distance, I apprehend it might be walked over in about the same time with less bodily exertion, and therefore with greater ease.

There are cases, however, where persons have not the free use of their legs, while their arms retain all their wonted vigour; to such parties a machine of this kind would be of infinite service. It is desirable, therefore, to put those persons in the right road who are wishing to construct such a machine.

In the case of Mr. Nicholson, he appears to be adopting the plan, familiar to the inhabitants of this metropolis, from its having been frequently seen in our streets; a carriage was constructed, and propelled at the rate of five or six miles an hour by six men, who each pulled a lever "*to and fro*" with a motion very similar to rowing, which acting upon cranks placed on the axle of the driving-wheels, turned them round and thereby urged the carriage forward. The conversion of rectilinear into circular motion, in this case, is attended with a great waste of power, and the plan I have pointed out would in practice be found more convenient as well as much more efficient.

There are cases, as I have already stated, in which manumotive vehicles would prove eminently useful; in general, however, to persons in full possession of all their natural powers, the *marrow-bone* stage will be the best conveyance.

Yours respectfully,

WM. BARDELEY.

London, Oct. 4, 1836.

CIRCULATING DECIMALS.

Sir,—I observe that the 25th volume of the *Mechanics' Magazine* is now completed, without your correspondent, "A Country Teacher," having named the "two different vulgar fractions" he had in his "mind's eye" at p. 175, the first seven decimal places of which are ·4256781. Mr. Peacock, p. 197, gives two fractions, which, he says, "if not identical, very closely resemble those referred to." However, p. 254, "A Country Teacher" denies them to be the two he had fixed upon, though without giving himself any farther trouble about them afterwards. Surely, after Mr. Peacock had answered his challenge, though erroneously, it would only have been courteous to have pointed out where the error lay. I must confess that I have fallen into the same error myself, though perhaps from a very different mode of calculation; the two fractions to which Mr. Peacock alludes being respectively the seventh and ninth of the series of continued fractions produced by the decomposition of the given number. It was my intention to have written a communication to that effect, but Mr. Peacock having forestalled me, rendered it unnecessary.

Though "A Country Teacher" has given us what he terms a hint, p. 254, yet his wording of it necessarily involves a contradiction. He says, p. 175, that the one is a pure, the other a mixed circulate; but, p. 254, he says neither con-

sists of more than eight places of figures: consequently, they must both be finite decimals.

Mr. Peacock's sneer, p. 109, at my "school-boy" method, I do not consider fair, since it was only by such repeated trials that I detected the fallacy of his rule, which he afterwards amended; in short, it is only by such that we can hope eventually to arrive at the truth. Doubtless, he did not gain his own knowledge of the subject by intuition.

I remain, Sir,
Your obedient servant,
G. C. L.

Kentish-town, Oct. 2, 1836.

MANIFOLDS.

Sir,—I wish that some of your correspondents would turn their attention towards the invention of a method by which several copies of the same letter could be taken off on letter paper. I had imagined, from seeing so many advertisements of copying-machines, that I should find no difficulty in obtaining something that would answer the purpose I have described; but on searching the London shops I find, to my surprise, that nothing of the sort is known. There are many modes of taking single copies of letters that a writer sends to his correspondent, and also of taking several copies on tissue-paper of the same letter; but not one by which a writer is enabled to take eight or ten copies of the same letter on letter-paper, to be sent to as many correspondents.

My business requires me to send every now and then eight or ten circulars, all precisely the same. It would be a great expense to have types set up for so small a quantity; and, besides, it is frequently requisite that I should observe secrecy; I consequently cannot trust the printer with the letter. It would employ eight or ten clerks to get all these circulars written out in sufficient time—and here, again, the secret must be confided to every one of them. I remember some years ago at Dublin, in a public office, a serious inconvenience arose from the want of some such invention as I have described. Twenty copies of a paper, which it was of the utmost importance to keep secret, were required, when no printer could be found whom it was thought safe to trust. I believe the Ministry have a lithographic-press in the Home-office; here, then, there is obvious risk of Cabinet secrets creeping out through the means employed to obtain the few copies wanted for the use of Ministers, which I believe never exceed twenty. You may remember an instance, some years ago, of an important paper getting to the public, I presume, through this channel.

It seems to me that the fairest prospect of attaining the desired end is presented by the art of lithography. Would it not be possible to invent some small portable machine, by which a letter, after being written in some sort of composition by the hand, might be transferred by the lithographic process to as many sheets of paper as might be required? Perhaps some of your ingenious correspondents will turn their attention to this point; and I will promise them that success will be attended by both fame and fortune.

I am, Sir, yours, &c.
LETERA.

Brighton, Oct. 10, 1836.

MR. MACKINTOSH'S FOURTH LECTURE ON THE ELECTRICAL THEORY OF THE UNIVERSE.

Mr. Mackintosh remarked, that at first view it appeared parodoxical that two effects so diametrically opposed to each other, as the formation and vapourisation of so hard a body as a diamond, by which he had illustrated the contraction and expansion of matter, should be produced by one and the same agency. But galvanism being a branch of electricity by the help of the electrical machine, the phenomena might be magnified so as to enable us to obtain a more distinct view of the mode of operation. If a body be expanded so as to occupy more space, this expansion must result from *repulsion* amongst the atoms constituting that body. If a body be contracted, the contraction must result from *attraction* amongst the atoms. This being admitted, it is evident that the expansion and contraction of matter must be effected by an agency containing within itself the principles of *repulsion* and *attraction*, and by no other.

Now let us turn to our magnifying glass, that is, the electrical machine. Here we find that two bodies positively charged, repel each other; that two bodies negatively charged repel each other, and that two bodies, the one charged positively and the other negatively, will attract each other; if instead of two bodies positively or negatively charged, we were to take a million, the same effect would follow; and if we sugpose those bodies a million of atoms, the repulsive force exerted amongst them will furnish us with a

faithful and literal representation of the expansion of matter. In the same way the attractive force exerted amongst a large number of bodies, one half of which are charged positively, and the other negatively, will exemplify the contraction of matter.

But here an objection presents itself—the electric fluid continually endeavours to establish an equilibrium, therefore the redundant fluid which caused the expansion will in time be dissipated, the repulsive or expansive force will be exhausted or destroyed, and the bodies or atoms will collapse; so, also, between positive and negative bodies or atoms there will be an interchange of fluid—the equilibrium will be restored, and the attractive or contractive force will cease to operate. If a perfect equilibrium could be established and maintained, no motion from electrical causes could ensue. This objection appears at first sight formidable, but nature has provided an answer: when fluid and solid bodies are in contact, as acid and zinc, the fluid will be found positive, and the solid negative. Here, then, are two bodies in opposite electrical conditions, and in contact, but the equilibrium remains permanently disturbed; indeed it is by this contact that it has been disturbed—at this point begins a power that will expand the hardest diamond into an invisible vapour—at this point begins the expansion of matter. The whole universe is filled with fluid and solid matter, therefore this disturbing force is in universal operation. Again, when two electrics, as the glass cylinder and silk rubber of the machine are in contact and in motion, one is found to be positive and the other negative; and if the motion be continued, the electric equilibrium is permanently disturbed. If it be objected that the continuance of the motion is a necessary condition, it may be answered, that all matter is in motion; wherever there is matter there also is motion. Here then are *two points* at which we find the electric equilibrium disturbed; and they are enough,—at one begins the expansion, at the other the contraction of matter. To these two points, all motion from electrical agency may be referred, and however small these forces may appear upon a limited surface, the aggregate is immense and fully adequate to the developement of all the phenomena connected with the motion of matter as resulting from physical causes."

All motion, he continued, proceeds in a kind of circle, that is, in a line that has neither beginning nor end—an endless chain; at one point of the circuit we find the expansive process; at another, the contractive process going on, the one force compensating the other; without which compensation the motion could not go on for ever. Heat and light are constant and faithful indications of the expansive process—the sun exhibits these indications in an eminent degree, therefore we conclude, that at the sun's surface the expansive process is going on—that the expanded matter is projected to the utmost limits of the solar system, is proved by its influence upon the vegetation of the earth, and by the reflection of light from the most distant planet. But if the motion is to continue for ever, this expanded matter must be again contracted and returned—and when by the rolling or twisting motion of fluids, by which friction is produced and the electric equilibrium disturbed, as well as by induction amongst the contracting particles, a large body of loose materials is formed; in what respect does this body differ from a comet? When the contraction has proceeded to a certain point, the body will be attracted towards the centre; but as it approaches the sun, a large proportion of its loose materials will be expanded into a tail, and the body will be again driven off from the centre under the expansive force. By a series of these revolutions, the tail or expanded matter being continually turned away from the sun, the comet's orbit must be widened and reduced to the planetary form, the loose materials continuing to contract, it may be further asked, in what respect does this body differ from a planet? He concluded by remarking, if matter recedes from the centre in proportion, as it is expanded, and returns to that centre in proportion as it is contracted, we have to enquire whether the earth is contracting, and this will form the subject of the next lecture.

LIST OF ENGLISH PATENTS, GRANTED BETWEEN THE 22ND OF SEPTEMBER AND 22ND OF OCTOBER, 1836.

Moses Poole, of Lincoln's-inn, gentleman, for improvements in anchors and in friction-rollers, to facilitate the lowering and raising such and other anchors, which friction-rollers are applicable to other purposes; being a communication from a foreigner residing abroad. Sept. 15; six months. (Omitted last month.)

William Pringle Green, of Falmouth, Cornwall, lieutenant, R.N., for improvements on capstans, applicable to ships and other purposes, and for methods or contrivances to reduce manual labour at capstans used at mines, such methods or contrivances, strengthening capstans, prevents them being overpowered, and are improvements on the modes hitherto resorted to for the performance of work; such capstans, methods, and contrivances being used conjointly or separately, and for raising ore and men from mines. Sept. 28; six months.

John Isaac Hawkins, of Chase Cottage, Hampstead-road, Middlesex, civil engineer, for an improvement in the blowing-pipe of blast-furnaces and forges; being a communication from a foreigner residing abroad. Sept. 28; six months.

George Crane, of Yniseedywyn Iron Works, near Swansea, iron-master, for an improvement in the manufacture of iron. Sept. 28; six months.

William Neale Clay, of West Bromwich, Stafford, manufacturing chemist, for improvements in the manufacture of sulphate of soda. Sept. 28; six months.

Richard Pearson, of Saint Giles, Oxford, organist, of Carfax Church, Oxford, for certain improvements in drags or apparatus for retarding carriages. Sept. 28; six months.

John Ledyard Phillips, of Melksham, Wiltshire, cloth manufacturer, for an improvement in the manufacture of woollen cloths. Oct. 4; two months.

James White, of Lambeth, engineer, for certain improvements on railways. Oct. 4; six months.

Charles William Stone, of Finchley, Middlesex, mechanic, for improvements in harness for weaving purposes, and in the apparatus for making the same; being a communication from a foreigner residing abroad. Oct. 4; six months.

Henry Huntley Mohun, of Walworth, Surrey, doctor in medicine, for improvements in the manufacturing of fuel. Oct. 4; six months.

Samuel Tonkin Jones, of Manchester, merchant, for certain improvements in the tanning of hides and skins. Oct. 6; six months.

Miles Berry, of 66, Chancery-lane, Holborn, mechanical draftsman, for certain improvements in machinery or apparatus for making or manufacturing metal screws. Oct. 6; six months.

John Sharp, of Dundee, Forfar, flax spinner, for certain machinery for converting ropes into tow, and certain improvements in certain machinery for preparing hemp or flax for spinning, part of which improvements are also applicable to the preparing of cotton, wool, and silk for spinning. Oct. 8; six months.

Henry Scott, junior, and Robert Stephen Oliver, hatters, of Edinburgh, for a certain improvement or improvements in the manufacture of hats, caps, and bonnets; being a communication from a foreigner residing abroad. Oct. 13; six months.

Frederick Benjamin Geithner, of Birmingham, brass-founder, for improvements applicable to the drawing or winding up of window and other roller-blinds or maps; which improvements are also applicable to other useful purposes. Oct. 13; six months.

John Hemming, of Edward-street, Portman-square, Middlesex, gentleman, for improvements in the manufacture of white lead. Oct. 13; six months.

Thomas Lutwyche, of Liverpool, Lancaster, manufacturing chemist, for certain improvements in the construction of apparatus used in the decomposition of common salt, and in the mode or method of working or using the same. Oct. 13; six months.

John Rothven, of Edinburgh, for improvements in the formation of rails or rods for making railways, and in the method of fixing or joining them. Oct. 13; six months.

Charles Pierre Devaux, of Fenchurch-street, London, merchant, for a new or improved apparatus for preventing the explosion of boilers or generators of steam; being a communication from a foreigner residing abroad. Oct. 13; six months.

John Joseph Charles Sheridan, of Peckham, Surrey, chemist, for certain improvements in the several processes of saccharine, vinous, and acetous fermentation. Oct. 20; six months.

William Bridges Adams, of Brecknock-crescent, Camden Town, Middlesex, coach-maker, for certain improvements in wheel carriages. Oct. 20; six months.

Christopher Nickels, of Guildford-street, Lambeth, manufacturer of caoutchouc, for improvements in preparing and manufacturing caoutchouc, applicable to various useful purposes; being partly a communication from a foreigner residing abroad. Oct. 24; six months.

LIST OF SCOTCH PATENTS GRANTED BETWEEN THE 21ST OF SEPTEMBER AND 22ND OF OCTOBER, 1836.

Francis Coffin, of Russell-square, Bloomsbury, gentleman, in consequence of a communication from a foreigner residing abroad, for certain improvements in the construction of printing machinery or presses. Sealed Sept. 24.

Matthew Hawthornthwaite, of Kendal, Westmoreland, weaver, for a new mode of producing certain patterns in certain woven goods. Oct. 4.

John Isaac Hawkins, of the Chase Cottage, Hampstead-road, Middlesex, civil engineer, in consequence of a communication made to him by a certain foreigner residing abroad, for an improvement in the blowing-pipe of blast furnaces and forges. Oct. 4.

George Richard Elkington, of Birmingham, gilt toy maker, for an improved method for gilding copper, brass, and other metals, or alloy of metals. Oct 4.

William Hinkes Cox, of Bedminster, near Bristol, tanner, for an improvement or improvements in tanning. Oct. 14.

John Pickersgill, of Coleman-street, London, merchant, in consequence of a communication made to him by a certain foreigner residing abroad, for improvements in preparing and in applying India-rubber (caoutchouc) to fabrics. Oct. 14.

Thomas John Fuller, of the Commercial-road, Limehouse, civil engineer, for a new or improved screen for intercepting or stopping the radiant heat arising or proceeding from the boilers or cylinders of steam engines. Oct. 18.

George, Marquis of Tweedale, for an improved method of making tiles for draining, soles, house-tiles, flat roofing tiles and bricks; the word "bricks" having been omitted in former patent of 25th May last. Oct. 19.

William Hale, of Croom's Hill, Greenwich, civil engineer, for certain improvements on machinery applicable to vessels propelled by steam and other power; which improvements or parts thereof are applicable to other useful purposes. Oct. 22.

The publication of the Supplement to Vol. XXV. is unavoidably postponed until the 1st of December.

☞ British and Foreign Patents takenout with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

A complete list of Patents from the earliest period (15 Car. II. 1675,) to the present time may be examined. Fee 2s. 6d.; Clients, gratis.

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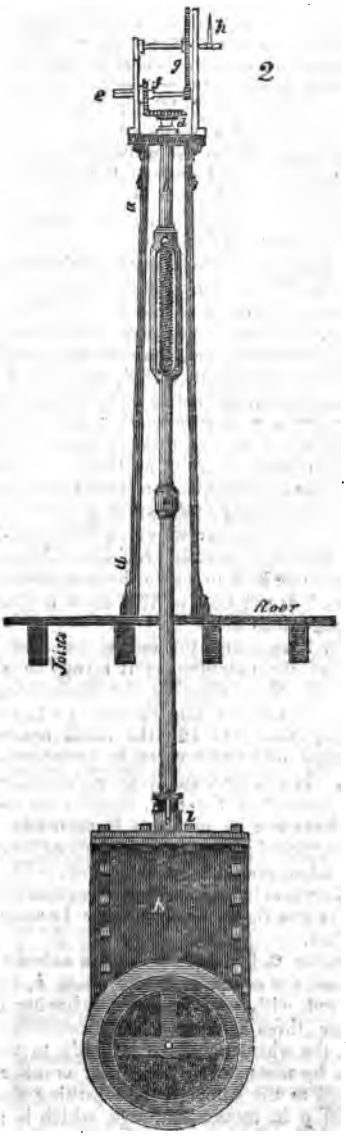
No. 691. SATURDAY, NOVEMBER 5, 1836. Price 6d.

HUTCHISON'S GAS AND WATER VALVE.

1



2

HUTCHISON'S GAS AND WATER VALVE.

Sir,—It has long been felt as a great desideratum by Gas and Water Companies that they should possess the most simple, and, at the same time, the most perfect valve for regulating the supply of gas or water. Hitherto all the valves that have been in use, owing to the complexity of their mechanism, the materials of which they are constructed, or both, have proved a source of considerable anxiety and disappointment to the superintendents of Gas and Water Establishments. Several ingenious inventions and improvements have from time to time been suggested and adopted, but all have more or less failed, or, at least, been only partially successful, causing great trouble and expense to the proprietors.

This has at last been obviated by Mr. Stephen Hutchison, the eminent engineer and patentee of the London Gas-Works, in the construction of a valve, which for simplicity, correctness, and durability, stands unrivalled, and will, I have no doubt, be largely patronised. Its construction is so simple, that a boy of eight years of age can put it into action with the same certainty as the most scientific man; while, at the same time, its mechanism is adjusted to that nicety that the supply of gas or water can be regulated with the greatest precision. I am happy to be able to forward you a drawing and description of this most useful and ingenious machine.

Fig. 1 represents the ordinary appearance of the machine as it stands in a room or office, showing the dial-plate, which is divided into thirteen parts or inches, from 1 to 12; the black space denoting when the valve is completely shut. It will be seen at once from the arrangement of the dial, that the greatest nicety can be obtained in regulating the supply of gas or water, alike avoiding a sudden pressure on the pipes, often causing accidents and that disagreeable jerk in gas-lights so observable in some districts.

a a, fig. 2, is a hollow shaft or column, through the centre of which passes *b*, an iron rod, with a screw or worm, having a square thread, as at *c*, and connected with the wheel *d*, which is made to revolve by means of a handle or crank *e*, affixed to the wheel *f*, also putting the wheel *g* in motion, through which is a spindle, having an index or hand *h*. The rod passes through the floor, and working in a cushion-socket *i*, is attached to the slide or valve contained in the box *k*, having a double groove, rendered perfectly air-tight. The drawing represents the valve as shut.

I am, Sir, yours, &c.

ENSOR.

ALARM ROCKETS.

Sir,—In your 887th Number, I perceive a statement concerning an invention for alarming poachers and thieves, instead of shooting them with spring-guns or maiming them with steel-traps. This consists in causing such persons to excite the firing of a rocket or other explosive contrivance, upon touching a wire or string, as was practised with spring-guns. I think I am entitled to state, that in this month (October) of last year, I ordered of Mr. Cannon, firework-maker, of the Westminster-road, certain parts of my contrivance for a precisely similar purpose, which I could not conveniently make at home; and explained to his wife the purpose to which I intended to apply them.

According to my arrangement, rockets, petards, or any illuminating fires, may be left exposed to any rain or weather for any number of months, without deterioration, and the strings or wires may be laid on or taken off at pleasure. I have tried the plan, and have had two "flair-ups" in my little garden since I first applied it. I do not think I shall have a third—as the whole neighbourhood was alarmed, and the parties implicated could not conceal their feelings.—Yours, &c.

F. MACERONI.

Oct. 8, 1836.

CHALKLEN AND BONHAM'S PATENT VICE.

Sir,—The unequal wear and strain on the screw and shoulders of the common vice, render it so liable to break and get out of repair, that a simple and effectual remedy for those evils will be acknowledged by all who make use of it as a most valuable and important improvement.

Messrs. Chalklen and Bonham claim to have overcome these evils, by a very simple alteration in the present construction of the vice.

Fig. 1.

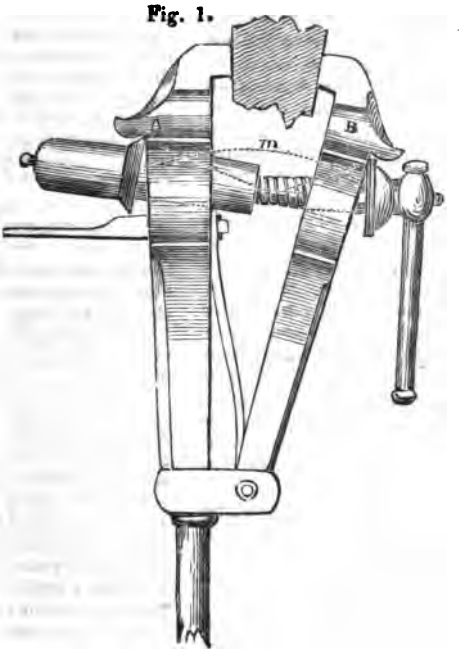
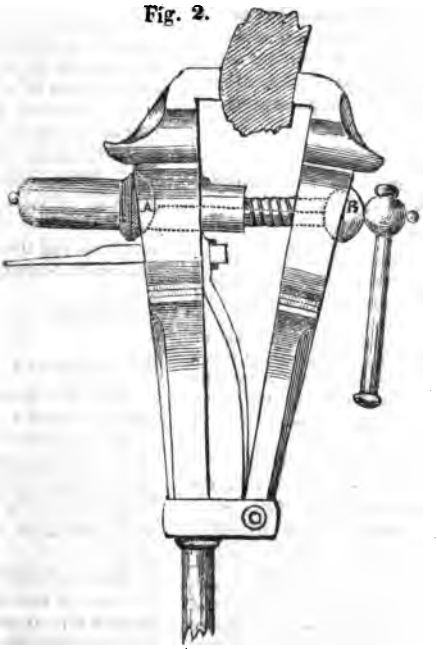


Fig. 2.



When the vice now in use (fig. I) has any thing in it, and screwed up, the whole of the pressure is borne by the two points A and B, and of course the

screw has a tendency to bend to the line *m*, and to throw all the strain on one part of the worm, &c.; hence arises the destruction of the worm, the bending of the screw, the wear of the shoulders, and in a short time the vice becomes completely out of order, which occasions the endless expense in large factories, where the work is heavy, of new boxes and screws every two or three weeks, besides a great difficulty to make them hold when opened wide. Messrs. Chalklen and Bonham's improvement is simply making the shoulders of the screw two hemispheres fitting into two sockets, A and B, fig. 2. Thus, in any situation of the vice, the force will always be uniformly distributed to all parts, and the direction of it remain in the centre of the screw: if the greatest power be applied it cannot injure or have any tendency to bend.

This is without doubt a very simple and important improvement in an apparatus used by almost every mechanic; and if it is found that the ball and socket does answer its end under a great degree of pressure (which appears doubtful), it will soon be extensively adopted. The Patentees have supplied a number to the Woolwich Dock-yard. There is another improvement in the vice which is a great desideratum, that is, a parallel motion.

I am, &c. A BLACKSMITH.

A PLAN WHEREBY A WOODEN RAILWAY SHALL BE RENDERED AS INDESTRUCTIBLE AS THE BEST IRON RAILROAD.

(From the *American Railroad Journal.*)

This plan consists in having the excavations and embankments made sufficiently wide to admit a side ditch, or ditches, and *extra* embankments raised upon the outer edges of the road to an elevation of fifteen or eighteen inches above the plane of the roadway. These *extra* embankments should be made about one foot wide on the top, with slopes of one and a half of base to one of perpendicular rise.

The *side ditch* or *ditches* with the *extra embankments*, and the *upper surface of the roadway* should be constructed with water-tight materials, and the ditch or ditches made with the sufficient cross section to admit a quantity of water to feed the required distance. The cross section of the ditches will be greater upon the level parts of the road than on the descending planes, and greater at the end where the water is introduced, and decreasing toward the final discharge or waste of the water.

The *feeders* should be admitted at convenient distances, the less the distance from one feeder to another, the less will be required for the dimensions of the ditches. *Waste weirs* should be built at proper points, so as to discharge all surplus water, and the feeding gates should be regulated to give a certain quantity of water and no more, as near as the circumstances will admit.

After the wooden sleepers and rails are laid, with the iron plate put on, and the road completed for use, the water should be introduced and maintained to an elevation that will completely cover the rails, leaving the track about one inch under water. This will be a sufficient depth, and need not be exceeded for the purposes here required to accomplish.

It is well known that wood *immersed completely under water* is thereby prevented from decay, hence a wooden railroad in the situation here described would last as long as the best constructed iron road.

The difference in cost of course would be different, as the circumstance and character of the ground would change; but I have no doubt but the average cost of railroad, upon this plan, would be 5000 dollars per mile less than the double track iron road.

There is hardly any situation where railroads of any extent are made, but streams of water sufficient for the purposes required can easily be obtained. In the *winter season* the water should be drawn off or reduced at least two inches below the top of the rail. There is but little tendency to decomposition during the frosty weather, hence but little objection can be urged against this measure.

The slight obstruction the water would be to the rapid progress of the engine and cars would be nearly balanced by having a constant clean and uniform surface for the wheels to run upon, the friction would be more equal, consequently the moving power could be better regulated.

A thin light wooden box should be made to enclose the wheels from near their bearing surface over the top, in order to prevent the centrifugal force of the wheels in motion from throwing the water over the bodies of the engine, cars, &c.

Many advantages might be enumerated in favour of this plan of making railroads. One is the uniformity which would be given to the temperature of iron plate, thereby correcting in a manner one of the great evils, the contraction and expansion of the iron plate. I believe, also, where a road should be made in this manner, and well settled, there would not be half the liability to derangement. It is the alternate wetting and drying causing the contraction and expansion of materials, which eventually disorganises the road.

MINUTES OF EVIDENCE BEFORE A SELECT COMMITTEE OF THE HOUSE OF LORDS ON THE TOLLS ON STEAM CARRIAGES' BILL. SESSION 1836.

[We gave in our last vol. p.335 the Report of the House of Lords Committee on the tolls on Steam Carriage Job, of Messrs. Goldsworthy Gurney and Co.; by which Report that very dirty job (to which this journal was the means of first calling public attention) was most happily frustrated. We now propose to select from the minutes of evidence taken on the occasion, whatever we can find of novelty or interest in them; passing over only such portions of it as consist of mere repetitions of facts and statements with which the scientific world is already familiar.—Ed. M.M.]

Mr. Goldsworthy Gurney

Has had no engine on the road since 1831; before this period they ran a good deal in the neighbourhood of London. Went to Bath and came back in 1829. Carriages in 1830 were established between Gloucester and Cheltenham, and ran there uninterruptedly for four months, three times a day. They carried upwards of 4,000 persons over 5,000 and 6,000 miles of ground without any hurt or accident. And not running on that road now, because they were stopped by turnpike acts, which laid a toll of 11. each time of passing at both gates, a distance of eight miles, making 22s. for each journey.

His carriage can be made to run round a circle of twenty feet diameter, at a speed of six or seven miles an hour.*

Cannot say exactly how many miles his carriages have run along public roads; but should think 15,000 miles.

Has not built an engine, nor had any one on the road since 1831.

Thinks that if his carriages had gone on and been persevered in they would have prevented some of the railroads now in operation. Is quite satisfied of that. By a little experience and management, steam carriages will go nearly as fast and fully as safe on a common road as on a railroad. After a twelvemonth or two years observation the public would be satisfied with them, and a rapid rate would be permitted. It is rather a singular fact that when you are travelling at the rate of eighteen miles an hour in a steam carriage on a common road you are not sensible of the rapidity.†

Have you ever travelled eighteen miles an hour in a carriage on a common road?—Yes; I have gone eighteen miles within an hour. From what place?—From Finchley to Regent's Park and back again twice, up the Highgate Tunnel. We travelled the first twenty-four miles in two hours in our journey to Bath.

Have all the boilers tried on common roads been attended with loss of life, if constructed above a given size?—I would not say that all have, but all I am acquainted with.

What is the extreme size you would recommend?—The extreme size for public safety I am of opinion ought not to exceed eight or nine inches diameter. I think it essential to keep within that size; they may be reduced still lower. I am sure all engineers of experience would bear me out in stating that this size is sufficient for all purposes on common roads.

The Committee are to understand that your carriage, though less in weight, has *more power* than the locomotive engines employed on railroads?—Yes, compared to weight; on a railway they are very heavy.

Have you heard of an instance which occurred some two years ago of the gates on the Liverpool and Manchester railroad being carried off in the middle of the night?—I recollect hearing of the circumstance.

Would such a thing occur with *your* carriage, if it were to come against a turnpike gate?—It might possibly, by charging a turnpike gate with full steam, and carry it away; but a man must be mad to do it.

Do you conceive your power is sufficient to do that under ordinary circumstances?—I think not.

Have you heard of an instance of Mr. Hancock's engine striking the corner of a house?—I was in the country at the time I heard of the circumstance, but I do not know whose carriage it was; I do not think it was Mr. Hancock's.* I simply heard of a wall being driven in at Paddington. A great number of caricatures of steam carriages have certainly taken place; a great many undigested experiments have been made on the public roads, which have tended much to prejudice the public mind against the subject.

What means do you propose for preventing the establishment of other caricatures, as you call them, of your project?—I think the toll being placed on the weight of the carriage will limit them in size. The clause in the bill subjecting them to double pressure will be also another means; I think the clause limiting the size of the boiler will be the principal. Possibly, if the prohibitory

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† Very singular indeed; but should it not be added, after the manner of the Americans, if *true*. —*Printer's Devil.*

‡ The carriage which performed this exploit, was Messrs. Macerone and Squires'.

tolls be taken off, and the subject be allowed to go on fairly, fair and legitimate carriages will alone be seen on the road.

In what manner do you propose to guard against the introduction of other carriages further than as the weight would prevent their running with success?—The weight of the carriage would be only one guard, the proof to which the boiler is submitted would be a second, and the limited size of the boiler would be a third. Those are as much as I can point out capable of legislation.

You were understood to state that there is no difficulty, however small the boiler, to raise the power of the engine?—However small the vessels composing the boiler, you may with vessels not exceeding an inch in diameter obtain forty-horse power, or even one hundred-horse power.

Do you suppose it would not answer for an individual to undertake to draw a train weighing twenty or thirty tons to pay a toll upon them?—In the first place, I think it would not be practicable to do it; secondly, the expense would be very considerably more than horses; for when we exceed a given relative weight the expense of steam becomes greater than that of horses.

Can you state what that limit is?—If I speak in engineer's terms, a horse power boiler should not exceed three hundred weight; if it exceeds this weight it becomes far more expensive than horses.

If you could have, without increasing the size of the boiler, a forty horse power engine, it is perfectly evident you could carry three times forty hundred weight?—I think I am misunderstood. In regard to pressure, I have been speaking of the separate vessels composing the boiler; if one vessel will generate steam enough for a horse power, then it will require two for a two-horse power. If you require a forty-horse power, you must have forty vessels, each vessel or series representing a horse power. The boiler for producing steam sufficient for a horse power must be practically under three hundred weight.

In your engine for every horse power you would have a distinct boiler?—For every horse power there is a given number of those tubes, increasing in direct ratio as the horse power is increased; so the number of those must always be increased in that ratio.

You were understood to say you could increase the pressure on your boiler to any given extent?—Certainly. The tubes when formed together compose the boiler as a whole; every tube will bear the same pressure.

You were understood to have stated that a boiler could bear pressure to a hundred atmospheres?—I said it was capable of almost unlimited resistance.

How would you restrain any individual from making a pressure on a given tube of above one-horse power?—I hardly understand the question. If he was to double the pressure upon a tube, the power of the engine would be increased. This is a question more of force or intensity than a question of power. Series of tubes would work the engine under the power of one hundred to an inch, or at fifty; the rate would determine the power. What is gained in power may be lost in time. The actual power is represented by the quantity of steam, not by the pressure.

Your steam carriages are totally inapplicable for merchandise?—Quite so; only for passengers and quick travelling.

With how many carriages is their train?—Not more than one.

You can go, you say, at the rate of eighteen miles an hour?—Certainly it can be done, but the best practical rate is from twelve to fourteen.

How soon after the new tolls were imposed did you give up running between Gloucester and Cheltenham?—Not till they were imposed.

How soon after?—Directly.

Did you find it a profitable speculation?—The speculation belonged to Sir Charles Dance; he was the proprietor of the carriage; and the speculation was his. It appears from the accounts of expenditure and return that there must have been a considerable profit.

You considered it a profitable undertaking?—Yes. I have a letter of Sir Charles Dance's, in which he states it himself.

Can you say why Sir Charles Dance did not try running in the neighbourhood of London, where there were no such tolls?—After he returned from Gloucester he became acquainted with Messrs. Maudslay and Field, the great practical engineers; they made alterations in the carriage, with a view of improving it. Experiments were made after that by Sir Charles Dance and Mr. Field, to determine the value of these alterations; but they never ran, nor did Sir Charles intend to run till we could get the question of tolls settled; it was not the particular road on which the tolls were laid then that stopped us, but the fact that wherever we attempted to run, or contracts were made, we were met by an Act of Parliament.

Was there any instance of an act being passed except where some great improvement took place on the road, or the existing act had expired?—I cannot answer that question as to the cause directly which occasioned acts to pass; but this I can state, that on the great line of road between London and Liverpool, Liverpool and Edinburgh, which were contracted for, the turnpike tolls were laid; also between Glasgow and Edinburgh.

Are you correctly informed on that?—Yes, as to the amount of tolls, but not as to the motives.

Was it on all?—On particular trusts.

Are you informed under what circumstances those acts were obtained?—I am not informed under what circumstances. I firmly believe they were misinformed as to the subject. There was no intention on the part of the trustees to put on tolls in the way of prohibition, but as a fancied just protection. In my petition in 1831 I stated this. I prayed that inquiries might be made, in order that just and equitable tolls might be placed on steam-carriages.

Then it appears it was only on certain roads that those tolls were laid?—On certain roads which occurred along the great roads, here and there, but so sufficient that if we take the roads from Liverpool to Edinburgh, taking all, "they would amount to 1s. for every mile run over, taking the whole distance;" this was stated in evidence by the contractor. If the tolls were laid on at the rest of the gates on the line in the same proportion, they would have amounted to 1*l.*

Are you not aware that you might have run during the periods, if the acts were still to exist; you might have run without any fear of an increase of toll?—Yes; but to what purpose? My object was not to run for profit as a coach proprietor; its public introduction was the work of great capitalists. I had not capital enough to introduce a subject of such importance; and the capitalists who were disposed to establish it, and had licences, were not disposed to go on with it when that spirit was shown on the part of the Legislature.

You had got the patent. Your object was not to run the carriages, but to sell the right of running carriages to other persons. You were not the person who gave it up, but they gave it up?—Yes.

You found no persons who would undertake to run with your patent, and in that way you were injured?—Capitalists undertook to run to a certain extent; contracts were made with great capitalists, but those did not withdraw from their contracts until the bill for their repeal was lost in the Lords. If this bill passes I could to-morrow find capitalists.

How is it that no capitalist have been found to run on the road near London, where no such toll is imposed, and where two or three carriages are running?—I conceive if carriages are now running it is on the faith of tolls being taken off, or they may be experimental carriages; but the reason why capitalists will not run carriages in the neighbourhood of town, is the fear of the spirit in which those acts have been passed.

It appears capitalists have been found to run other carriages. Hancock runs his own coaches?—I do not think any capitalist would be disposed to run short stages; the great advantage is in long distances; the stopping on short stages would increase the expense very much in the consumption of coke and other expenses.

Do you apprehend Hancock's is an unprofitable speculation?—I have not a conception whether it is or not.

The question is, how do you conceive it arises that no person has bought of you the right to start a coach near London, when other coaches have been running and plying for hire near London?—In 1831, when acts passed, I shut up my establishment, and I retired from the subject, at that time feeling injury had been done to me, and thinking I was unfairly treated; when the repeal did not pass I sold all my materials for manufacturing, and gave up my manufactory. Capitalists would not apply to me after that, and I have not applied to them. I have been engaged in other pursuits lately, waiting in the full expectation that the question would be soon settled so as to enable me again to apply myself to the subject. I may be allowed to remark that the instant this bill passed the Commons, and it was expected it would pass the Lords, large capitalists have applied to a considerable extent, to whom I have granted licences.

Mr. Walter Hancock.

Has now three steam-carriages running between Paddington and the Bank. The engines to each carriage are of two four-horse power; perform about twelve miles an hour, and consume from a bushel and a half to two bushels of coke an hour.

Have you ever been in the back part of your coach when it was travelling?—Frequently.

Have you seen whether any sparks came out of the bottom?—In the former part of my experience I found that a great objection, and I in consequence formed the fire-place so as to prevent any coming out, and now you may travel hundreds of miles in my carriage, and not see a spark come out of it. It was a matter of difficulty to get over the objection, but I surmounted it by excluding the possibility of any spark being seen.

You have stated that no sparks came out at the bottom; does any smoke come out at the top?—No. We have destroyed both the steam and smoke. Occasionally when the gas is not so clear as it generally is there has been a little smoke seen.

Do you use coke of any particular sort?—The common gas coke.

How do you let off your surplus steam?—I have two safety-valves. It is not heard; there is no noise of steam escaping.

How do you avoid that?—There is an apparatus in the carriage that prevents it, so as to deaden the sound.

The noise is there, but deadened?—The force is there, but deadened before it flows out in the common atmosphere; but this is not allowed; it is gradually spent.

Is that by taking it into a larger chamber?—I think there are about twenty or thirty of those chambers the steam passes through.

Do any sparks fly out at the top of the chimney?—I never discovered any; there have been great improvements of late.

What are your great improvements?—They throw the steam in a particular direction so as to come into contact with the fire, after it has passed the chamber; the steam not passing out, as in common locomotive engines, has not the power of drawing up the ashes as in the common engines.

Have you had any accident with your carriage?—I never had any accident myself; there was one accident occurred, but there was no personal injury by it; I never had an accident occur with my carriages upon the road from the boiler.

Did any accident occur with any carriage?—Yes.

When was that?—I think three or four years ago.

None has occurred since that?—No.

Was that when the carriage was in motion?—It was on the first trial of a new carriage called the "Enterprize," a carriage now running for hire on the City-road. The man who was attending the machinery did not thoroughly understand the nature of the machinery, and he got one of his safety-valves at work. He had one valve tied down. We had what we call a blowing-machine to produce a greater heat; he had immense heat. I have no doubt he had the boiler filled full of water. The engines going very fast increased the pressure to as nearly as possible 1,400 lbs. upon the inch before it rent itself. The engineer, on his coming up the yard, says, "For God's sake release that valve." In the act of his turning about the rent took place; he was so paralysed he never could be restored.

How did it produce this effect; was he wounded?—No; not touched in the least.

Where was this?—Down at Stratford, at the manufactory.

You mean that the valve was confined?—Yes.

Was any one hurt upon that occasion?—No.

What became of the man?—The doctor could not bleed him, and he died in consequence of fright.

Have your boilers ever burst?—I have had rents in the boilers I suppose a hundred times.

Have any bad consequences ensued to the passengers?—No; quite the contrary. On the road we had been running very successfully all the day. We were taking in water. One of the chambers had given way, and when we were about to start again there was not half the pressure. We examined into the cause, and found that the bottom part of one of our chambers had rent about an inch and a half. We had just steam enough to get the carriage to the yard; it produced no noise whatever.

There were no inconvenient consequences resulted?—No; only the delay.

How long have you been at work on steam-carriages for the road?—I think the last nine years.

Do you know how many miles your carriages have travelled?—I should be quite within compass if I said 30,000 to 40,000 miles.

How soon can you stop?—I have been obliged to stop the machine within two to four feet. A boy fell down before the carriage, and it was not three feet when I stopped it.

Can you stop at that distance?—I can stop within two feet going up hill.

What is your usual pace of travelling?—I generally go eight miles an hour. In going to Birmingham we averaged sixteen and seventeen miles an hour at times for hours.

In how short a space can you stop on a good hard road?—That will depend upon the speed we are going.

If you were travelling eight miles an hour?—Within ten feet; the man puts his hand upon a lever to turn the steam off, and gives a signal to put on the break.

What is your charge per mile?—It is sixpence from Paddington to the Bank, which is about five miles; rather more than one penny a mile.

What is the charge of the omnibuses?—The same.

What is the weight of your machine and carriage altogether?—I should think about three tons and a half to four tons.

What tolls do you pay?—On the Paddington-road 4d., that is, on the City-road.

What is the rate on other carriages?—An omnibus pays 2d. for carrying the same number of passengers.

The danger of a boiler bursting is in proportion to its size, is it not—on the same principle that a cannon requires to be made stronger than a smaller gun?—That will depend upon the size and thickness. In my boiler all the braces would require to be stronger, and the outer plates stronger. Those boilers, I have no doubt, would bear a pressure of five to six hundred pounds the inch.

You stated that you make the same charge

that the omnibuses do; could you afford it rather cheaper?—The money I have lost in experiments has been from 10,000*l.* to 12,000*l.*, and I have sacrificed nine to ten years full of my time. I ought to get as much as I can by the fare, but not to make it unreasonable.

Do you find your carriage fills?—Very well indeed.

Does it fill with persons who go in it once from curiosity, or persons who regularly go by it?—We have regular customers.

Do you perform the space in less time?—Yes; we average from the City to Paddington and back from an hour and a quarter to an hour and twenty minutes.

What is the distance?—Nearly ten miles.

What do the omnibuses take?—Before I came upon the road they were two hours and twenty minutes; but now they do it in nearly the same time that I do, being driven to it by the competition through steam. It has produced a public good in that respect against the will of the drivers.

Do the omnibuses contrive to go as you do by an increase of their positive speed, or by abstaining from stopping?—Both.

What is the average pace you go?—About nine or ten miles an hour; the omnibuses go from eight to nine miles an hour.

How many horse power have you on your engine?—I think it is between eight and ten on the "Enterprize;" the "Era," I think, is about eight.

You reckon that as equivalent to having how many horses attached to your carriage?—We reckon both of those to carry passengers equal to an omnibus with two horses, but I take into consideration the weight of the carriage and the weight of the horses. There is a mistake in the Bill. I think now that we shall pay double the tolls that other carriages do. We are not allowed the weight of the horses and the weight of the carriage. We suppose a horse draws one ton, and that is measured for a steam-coach; then there is no consideration of the weight of the horses and the vehicle drawn by the horses.

You think that even if this Bill passes in its present form steam-carriages will be at a disadvantage as compared with other carriages?—Yes. We ought to have two tons and a half instead of a ton allowed to one-horse power, to include horse and cart and load, the weight of which will amount to two tons and a half.

You calculate a horse power in a steam-carriage to be equivalent to three hundred weight?—Yes.

You call the draught by a locomotive-engine of one horse power equivalent to three hundred weight; consequently, before you could draw a ton, you must have three-horse power to do the same thing?—The "Era" carriage drew the "Infant." The "Infant" and the "Era" are about the same weight, about three tons and a half in weight. The average speed of the "Era" is about ten miles an hour, and with an engine behind it went about the rate of seven or seven and a half an hour. I consumed no more coke in the distance in those seven miles. According to that our carriages will draw about the same weight with the same steam and water, but we lose about two miles and a half per hour in speed. A horse power we consider equal to lifting 250 lbs. over a pulley, and that is very different from drawing; a horse power is considered as equal in drawing a ton. If we were to run one of those carriages the day through it would do as much as thirty horses.

Your carriage does work equal to thirty horses?—Yes; if they were to keep on the whole day. The work I am doing now is about equal to ten horses. Ten horses would be employed to do the same work. Five journeys from Paddington to London would take ten horses. This is about the same.

Do you go at the rate of ten miles an hour through the narrow streets?—No, certainly not; we pass through the streets very gently. I have been through the streets in the City hundreds of times, and persons would hardly know we were passing.

Do you concur in the opinion that there is much danger arising from a large boiler?—So much depends upon the principle on which it is made. I have no objection to a boiler of 100-horse power on my principle; there is no difficulty in making a boiler of the size of this room upon that principle; it can be extended or increased by increasing the number of chambers.

That is a number of small boilers joined together?—Yes. I can increase the size of the boiler by increasing the number.

The question refers to one large boiler in its own capacity?—Under any circumstances I rather feel timid in a steam-vessel with a large capacity. When we come to increase the size of the surface it has a greater effect to burst if metal is weak.

What is the largest boiler which you think could with safety be used on the public high roads?—A cylinder of twenty inches diameter, if the materials are well selected, and with the proper proportion of thickness, produces as great a safety in proportion as any other vessel. The cylindrical form is strong, but it is no stronger than any thing that is square, if the parts of the vessel are supported with sufficient materials. It all depends upon the thickness. The strain of a cylinder is the same as if it were of a given length, and was pulled at each end. If the thickness of the metal is not sufficient to sustain the pressure inside it will be sure to

sent. and a cylinder of twelve inches may be made equally dangerous, if it is not strong, as one of twenty.

Would the danger from blowing up a cylinder of ten inches be equal to that of blowing up a larger cylinder?—Certainly. A cylinder of ten inches, if it communicated to any other part of the boiler so as to make a continuous explosion, it would be nothing more than a discharge from the engine with greater report If one of the bolts in my boiler was to break I should have twenty-five safety valves; there will be fifty apertures for the steam to escape, and there will be nothing like a report. All the seams or joints will be open, and the steam will escape, and lose its force.

It is in evidence that for public safety the extreme size of a boiler ought not to exceed eight or nine inches in circumference, and that it is essential to keep within that size. Do you concur in that opinion?—I think that a vessel of three times the size of it is capable of bearing the power. There is no necessity for limiting the size if the vessels are sufficiently strong.

The objec of that observation was, that if it was not sufficiently strong, and did explode, no damage would arise; that is your opinion?—If it were twenty-four inches, and were to burst, I do not think that there would be any danger if no longer than three feet. I am making a carriage where the cylinder will be sixteen inches in diameter. and vessels containing a much larger portion of steam than a cylinder for a ten-inch boiler.

What is the object of that carriage?—For passengers.

Do you conceive that this method of travelling upon the high roads can ever be adapted to the conveyance of heavy goods?—Yes; I think passengers may be taken in the steam carriage itself, and goods behind.

The question respects heavy goods?—Yes. Not the heaviest goods; perhaps they would not be so profitable; but light Birmingham goods, and things of that description.

It would not be likely to supersede the heavy waggons?—I think it is very probable it might; in fact I consider it a medium superior to horse conveyance, and inferior to the railroad in regard to speed, but likely to prove much more profitable.

Are you acquainted with Mr. Gurney's plan?—Yes. We differ entirely.

You imagine yours to be preferable?—I think the fair answer to that would be the great expenditure Mr. Gurney has made to bring it to bear; and that mine have been brought into use at a much less expenditure, say one-fourth, and all at my own expense. Mr. Gurney had the capital of a number of persons.

You consider the advantage of yours to be principally in economy?—I consider that my boiler stands the work much better than his. I had some difficulty in getting the proportions of strength of iron-work to the machinery.

Your other machinery is pretty nearly the same?—The arrangement is different. The whole is on springs in mine, and upright; and his horizontal, and a crank axletree; mine is straight.

You have both adopted a mode of getting rid of the draught through the chimney?—I have a blowing machine, so that I can increase the draught at pleasure.

Do you not use the steam for that purpose?—No; it makes too much noise; it would frighten the horses.

Does Mr. Gurney's carriage make any noise?—It made a hissing noise when I saw it, just before it went down to Cheltenham and Gloucester, from the escape of the steam into the chimney. There was a very good draught, but it would make too much noise for us. It is the same as is adopted on the rail-road. If I adopt that plan I should frighten the horses off a common road.

You think that his carriage would frighten a horse off the road?—I am quite confident that the letting off the steam without its being quieted would frighten horses. If we could use the steam in the chimney without producing any nuisance we should save a considerable expense.

You would not be afraid of any competition from Mr. Gurney running against you?—I should not be afraid of competition.

Do you think any other carriages which have been running can be put into competition with yours?—The thing stands entirely upon its own merits, and the best will be appreciated.

Mr. Joshua Field called in, and examined.

Have you turned your attention to the construction of locomotive-carriages to run on public highways?—I have been employed in making experiments on this subject by some gentlemen as a matter of business.

Is there an engine goes by the name of Field and Maudslay's?—The machine in question was made for some gentlemen; it was not our property.

Will you state what was its weight, and how many persons it was constructed to carry?—It weighed, with water and coals, six tons; it was merely a drag to draw another carriage.

How many carriages would it draw; one or more?—It was generally applied to draw

one ordinary omnibus; but it has drawn two and three.

Along what sort of road; a good hard road?—The roads about London.

Gravel roads?—Yes, or Macadamised.

Is it at work now?—No.

Was it meant to work?—It was built as an experiment.

To try what?—To try what might be done on the roads.

Did it succeed?—Yes.

What was the object you wanted to attain?—The object of the party was to give the subject a fair trial.

Did it ever run any length of time?—It performed many journeys last summer.

On the roads immediately about London?—Yes; it went various times to Reading.

Drawing carriages after it?—On those occasions it drew one carriage.

What rate did it travel at?—From twelve, fourteen, fifteen, sixteen, and even at the rate of eighteen miles an hour.

What was the pressure; how many horse power?—It is difficult to estimate the power of such a machine by horse-power without the resistance being known.

What other means of estimating the power of a steam-engine have you?—Fixed steam-engines are easily estimated by horse power, but the power of a locomotive engine varies with every rate at which it runs.

In proportion as you increase the rate you would lose the power; what you gained in velocity you would lose in power?—Not exactly so; it would take more power to drive a carriage sixteen miles an hour than it would twelve; at the highest velocity it would exert the greatest power.

Have the goodness to give the Committee some way of estimating the power of an engine in any way you think you can explain it most satisfactorily?—The ordinary mode of estimating the power of a steam-engine is to ascertain the effective pressure of the steam on the piston; the area of the piston, and the rate at which it travels, reducing this to pounds weight, moving one foot per minute, gives the power of the engine moving at this rate; then dividing this sum by 33,000lbs., which is supposed to be the weight one horse can raise one foot in a minute, gives the number of horses power.

Apply that to your engine, if that is your mode of estimating the force of an engine; apply that, and tell us what the power of your engine was in that carriage?—That would be extremely difficult to do in this case, some of the data not being known; but I think the object of the inquiry would be answered by stating that the cylinders were ten inches in diameter, the steam from 50 to 100lbs. on the square inch, and sixteen inches stroke; such an engine may be estimated at about twenty horses' power.

You had a number of cylinders?—Two.

What length of time did you complete your journey to Reading?—Three hours and ten minutes average both ways.

How often did you go there?—It went five or six times down that road, some journeys to Slough, and once to Marlborough.

Did you go with it?—Once only to Slough, and once to Marlborough.

Did you observe that your carriage frightened the horses on the roads?—Occasionally horses would shy.

Have you seen any serious accidents?—No.

Did the horses shy more or less than at meeting a stage-coach?—More so, from the novelty of the thing.

Would a noise accompany your carriage?—A little.

From the carriage or the steam?—More from the hissing of the steam.

Were there any sparks; none were visible by day-light?—No.

Have you ever travelled by night?—On one occasion.

Were there any sparks?—A considerable number.

Have you taken any precautions or tried any thing to prevent the emission of sparks?—We had at one time a wire-gauze over the top.

Did it answer?—As it rather impaired the draft it was taken off, and was not on when we travelled by night.

Have you seen that wire-gauze applied to other locomotive-engines on railroads?—Yes.

Travelling at the same speed?—Yes; at all speeds on the railroads they have gauze.

Have you seen them travelling at the same speed, fourteen miles an hour, or whatever it is, with the wire-gauze on the top of the chimney?—Yes; and at much higher velocities.

But at that velocity did not sparks fly out, and would they not at a more great velocity than at a moderate one?—I never observed any.

When they travelled at that velocity have you observed the sparks fly out, notwithstanding the gauze?—I have only travelled by day-time.

Did you use coal or coke?—Coal and that accounts for the great number of sparks.

Is yours a large chamber—the boiler?—It was divided into a great number of small tubes.

Of what size?—The largest was two inches in diameter.

Were they cylindrical?—Yes.

And so small as that?—The largest part

exposed to the pressure of the steam was only two inches diameter.

How much coal did you consume in an hour, do you know?—I cannot speak very accurately to this, as those experiments were made more to ascertain the effect than the quantities of coal consumed.

Did you observe what effect it had on the road; did it make ruts?—Not at all.

What was the width of the tire of your wheels?—Three inches and a half.

They did not sink into the road?—No, not at all.

Were the roads wet or dry?—These experiments were chiefly made in the summer, but the carriage has run when the roads were soft and muddy.

Then it was very dry weather?—Yes, for the most part.

Have you ever travelled by any of the steam-carriages that go by the name of Hancock's?—Once.

When was that; lately?—It was about eighteen months ago.

Do you know his construction?—Yes, generally.

Do you consider it safe?—I think it is.

Where was it you travelled; on the New-road?—Yes.

Did you observe that the horses were frightened at it?—No.

There was no starting?—No.

Did the horses pay more attention to it than they did to the Paddington omnibuses or the Paddington stages?—I did not observe that they did.

You conceive the mechanism is such as to secure safety to the individuals who travelled by it?—Yes.

Did it seem to move and turn very readily?—Very easily.

You had no accident with it while you were upon it?—No.

Have you ever seen Mr. Gurney's steam-carriage?—I never saw one of Gurney's under way, except an old one belonging to Sir Charles Dance, quite altered as it regards the boiler.

But not Gurney's most improved and last-made carriage; his best carriage?—No.

Do you know the nature of the construction of his carriage?—Yes, as it was five years ago.

Do you consider his safe?—I did not consider the large flat-sided chamber safe.

But not latterly; it has a round cylindrical tube?—I do not know.

Do you know Colonel Macerone's?—No.

You do not know any thing about it?—No.

Are there any others you know, whose mechanism you are acquainted with?—I have seen Mr. Ogle's, but not at work.

Do you know the nature of his plan?—Yes.

Do you consider that safe?—Yes; I think the boiler safe.

Safe with respect to explosions?—Yes.

You have never seen it under way, therefore you do not know its effect?—No.

The only one you have seen tried is the one you built, and Hancock's?—The only steam-carriages I have seen moving are that we built ourselves, and an old one of Sir Charles Dance's, partly composed of one of Gurney's original carriages, Mr. Hancock's, and one made by one of my partners, which was a railroad-engine, put on the road with plain wheels for experiment.

Have you seen that under way?—Yes.

Do you consider the mechanism of that such as to be safe for passengers?—Yes; as safe as the ordinary railroad-engine.

Did you find the horses start at that?—A little; not much.

More than at Hancock's?—I think so, as the noise is greater from the escape-steam.

Did Hancock's make a noise?—Not much.

Is it the rattling of the carriage, or the whizzing of the steam?—I think about half each.

They do not neutralize each other?—No.

You have never seen Gurney's?—No.

Did horses start at Sir Charles Dance's?—A little occasionally.

More than at Hancock's?—I cannot say, but should think them much the same in that respect.

Do you know the mechanism of that of Dance's?—Yes.

Do you consider that safe?—It is just the same as one we made as it regards the boiler, and the mechanism very similar.

You consider yours safe of course?—It is quite safe from explosion.

But is it safe in other respects; is it safe to travel along the road with?—Yes.

Not only for the persons travelling, but for the persons it meets?—All carriages going at great velocities make more noise, and are consequently more likely to frighten horses.

Do you think they are as safe to meet as a mail-coach?—Until horses are more accustomed to them.

You think there might be considerable danger at times from horses taking fright?—Yes; from this as well as from any other cause.

How would the effect of them be at night, as far as you can judge?—At night the flame and the sparks are an objection; improvements may obviate this.

They are visible?—Yes, at night, when coal is used; less if coke is used, as is the case with Hancock's and some others.

You never saw it?—No; but from the manner in which Hancock's flame is divided and the heat absorbed, I should think it likely that less flame would be visible.

Do you think his plan, as far as you can judge of it, would secure you from sparks falling in the road?—I think it might be lessened in every construction by a gauze at the top.

Are you of opinion that gauze at the top is an effectual remedy against the emission of sparks from locomotive engines?—Not the smallest sparks perhaps, but the largest, certainly.

That would apply in the same way to Mr. Hancock's?—Yes, just the same.

Could you make a gauze sufficiently close to keep a draught, and prevent the smallest sparks escaping?—That object can be attained only by increasing the gauze head to such extent that the sum of all the openings in the wire shall be equal to the area necessary for the draft.

But do you think that object has been attained?—I do not know that it has.

Part of Hancock's plan is the one adopted on railroads also; to turn the steam into the chimney to create a draught?—I rather think he turns the steam into the ash-pit, and so lets it pass with the air through the fire.

And then it goes up the chimney?—I am not fully acquainted with the construction of it.

You say you think danger would attend the use of steam carriages till the horses were accustomed to it; at the same time you say, when you travelled by Hancock's along the New-road, there was no appearance of the horses being frightened?—No, there was not; and I think the noise and the smoke might be very much abated if it became a general thing. In the experiments I have been mostly engaged in that has not been so much an object as to produce the effect.

What legislative provisions would you suggest to enforce a due attention to that object?—I am not prepared to suggest any.

What would be the mode of doing it that would occur to you to induce engineers to turn their attention to that point?—Any thing that would induce or oblige them to lessen the noise, flame, and sparks.

With regard to the smell, is there not a great effluvia arising from Hancock's carriage?—I have understood there is; I did not perceive it.

When you were travelling along by it you did not perceive it?—No.

What is it from?—It is from the steam passing through the fire, and the products of the coke.

Have you any opinion of the size that it would be desirable that the boilers to run along high roads should be allowed?—I think it difficult to prescribe a rule of that kind.

Do you think it possible in any case danger could arise from a boiler that is cylindrical, of which the diameter was not more than ten inches, supposing it were to burst?—If it exploded, even that diameter would produce mischief to those who were near it.

The notion is to divide the boilers into chambers, and the chambers should not exceed ten inches in diameter; do you think danger would arise from the bursting of that?—I should be afraid to stand near one when it exploded.

Can you state that size of the chamber which, if it was to explode, would not be dangerous?—I should think any chamber exploding beyond three inches in diameter would be dangerous.

Below that you think no serious harm could arise?—No; it would rend, and let the steam out.

Do you find it very difficult to get men capable of managing locomotive engines on roads or on railroads?—There has been so little experience hitherto that we have always trusted the carriage to one steersman, who is very expert, and have never had any accident. He is a man formerly in the employ of Sir Charles Dance, and who came to us from him. I have travelled some hundred miles with carriages which he has steered, and he has in no instance met with an accident.

What carriages were those?—It was the old carriage of Sir Charles Dance's and that made by us.

You have been many hundred miles on that?—Yes; and that we made last summer.

As you probably employ a great number of men of that class, do you think there are many men capable of conducting a steam carriage?—I think every coachman would be able to steer well with practice.

You mean a good coachman could conduct a steam carriage?—Yes.

And your engineers, you must have an engineer with your carriage besides?—Yes.

Is that a class of men you can easily find?—Yes.

And capable of doing it?—Yes, very easily.

Is there any such nicety in the work that if they were to get drunk, or take too much, they would be liable to accident?—Not more so than on a railway, or a locomotive engine, or a steam-boat.

But on a railway the locomotive-engine could not have the opportunity of stopping at different public-houses?—Certainly not.

Therefore there would not be the same probability of a man getting drunk?—The steersman may be considered exactly the same as a stage-coachman in that respect; all depends upon his care.

You think there would be no more risk from a drunken engineer than from a drunken coachman?—They are much the same.

There would be no more danger arising from the misconduct in that way of an engineer than from that of a coachman?—No; I think not.

And that the engine is not a more dangerous vehicle to be conducted?—No.

Within what space could you stop your engine that you went to Reading in, going at the rate of twelve or thirteen miles an hour?—In about the space a coach would stop.

Three or four yards?—Yes.

It was in Sir Charles Dance's you travelled so far, and is that as easily stopped?—I spoke of that, and the carriage we made.

And would it turn as easily?—Yes.

Would it turn as easily as a stage-coach to get out of the way?—Quite so.

Could yours?—Quite so.

And does Hancock's?—It is quite as manageable as a stage-coach.

Do you think it desirable on high roads to have drags for other carriages, or to carry the passengers on the engine itself?—I should think passengers would be more comfortable in a separate carriage.

Which would be the safest for the public?—A separate carriage.

Do you not think that the length of the carriage on the road would be a serious inconvenience, and be attended with considerable danger?—It is not longer than a coach and four horses altogether, with the drag.

Would you think it dangerous that a carriage of the length of one of the great timber-waggons that you see should travel on the high-road at a great speed?—Extending the length beyond certain limits would increase the danger.

You think it would be desirable that that length should not be extended?—The shorter it is the better.

Do you think it would be desirable to have any mode of testing the boiler of steam-carriages?—I think they should be tested.

You, of course, use some mode of testing them before you send them out of your factory?—Yes.

Would there be any means of enforcing such a test to prevent neglect on the part of engineers, to prevent mere adventurers?—I think it might be done.

How could it be done entirely?—By forcing them with water. It would require some officer to examine and to see them tested.

Is there any difficulty in the use of the instrument you use to test them to require a scientific person to apply it?—Not at all.

Any individual might do so?—Every carriage has a hand-pump, which is an instrument by which the boiler might any time be proved. The pump which fills the boiler before starting, or in case of the water being short, that pump is the most appropriate instrument for proving the boiler; so that if the safety valve was weighted to double the extent at which it was determined the boiler should work, it might be proved at any time.

Might it be proved, suppose the Legislature required that the boilers should be tested before a magistrate, would he be capable of seeing the test was correctly applied, or does it require a scientific person to do it?—It requires a scientific person, or it might be evaded.

Is there any means to be adopted by which such a test should not be evaded?—I can suggest no other than that of a qualified person to superintend it.

What do you think might be the test of a boiler; how many times the pressure that is intended?—I should say double.

You think that sufficient?—Yes.

What test do you generally adopt in your boilers?—Our boiler was so strong that it would have borne five times the pressure we worked it at, so that we were free from any apprehension of explosion.

But with boilers generally you know to what pressure it is intended to subject them, and you subject them to a test?—Boilers having to sustain great pressure are tested double.

When you make high-pressure engines you must test them?—Yes; to double the pressure intended to be used.

You think double the pressure required would be sufficient?—Yes, I think it would.

If there were a provision that it should not be lawful to use any vessel to propel a carriage any part of the transverse section of which should not exceed ten inches circular or cylindrical—you think that is too large an allowance—do you think that would not secure safety to the passengers?—It would certainly be dangerous to passengers if it should explode.

But if it is properly tested there is a security against explosion?—It would be safe if it were made sufficiently strong and tested.

If it were not made sufficiently strong it would not stand the test?—No.

If it does stand the test, you think there would be no danger in that?—No; making allowance for decay.

You say you knew the principle of Gurney's mechanism, and you thought it safe?—Yes.

Was not that the principle of his chunk-

ters of his boilers?—The cylindrical vessels were considered safe, but the square flat vessels which he used at one time I did not consider safe.

But the cylindrical were his patent?—I do not know what his patent is.

Though a vessel may have been tested and pronounced to be safe, yet is it not possible that it may be used for too great a time, and that danger may arise from that circumstance?—Certainly it is.

Can there be any limit fairly put as to time without doing injustice?—I think no limit could be set as to time, for a boiler may be as much injured in one day, and its strength impaired by accident, as in ordinary wear it would be in twelve months.

The test is only a guarantee of safety at the time it is applied?—Exactly so.

Those chambers may be perfectly safe at one moment, without any appearance of danger, and may burst the next?—It is quite possible.

I do not know if you are of opinion that a small chamber, though it should burst, would not produce any disastrous consequences?—I am perfectly aware of that. Indeed the boiler used in the experiment in which I have been engaged is one for which Sir Charles Dance, in conjunction with myself, has a patent, the principal feature of which is, that no part of the boiler exposed to the pressure of the steam should exceed three inches in diameter, and therefore may be considered perfectly free from danger from explosion under any circumstances with any degree of wear, so as to remove entirely the apprehension of any danger to the passengers from the explosion of the boilers.

Mr. Benjamin W. Horne, Coach Proprietor.

There is great hostility among coach proprietors to steam-carriages, is there not?—Not at all. If we should prefer either, we should prefer those on the high road to those on the railroad, for the competition is greater. I speak with a degree of honesty.

What weight do you require a horse should draw in a stage coach, a coach fairly loaded?—They so much vary; from two to three tons.

In your own establishment what do you calculate the weight of the fast coaches when loaded?—About two tons; not exceeding.

You have some coaches faster than others?—The difference of about three miles an hour.

The fastest go about ten miles an hour?—Eleven.

What is the full weight of a loaded coach going at the rate of eleven miles an hour?—Not exceeding two tons.

What is the full weight of a loaded coach that does not go more than eight miles an hour?—They are short coaches that go merely to Dorking, Sundridge, and Egham; they do not go at the rapid speed as others do.

Have you any that go eight miles?—All distances.

Have you any eight mile an hour coaches?—Yes, a Dorking coach that goes eight or nine miles an hour.

What is the weight of that loaded coach more than the others?—It is the same as one that travels from 70 to 100 miles; it is the day and night.

The day coach does not exceed two tons?—About that.

What is the weight of a night coach?—It might be perhaps occasionally according to the season of the year; if it is a mercantile town it varies; it is occasionally half a ton more; two tons and a half.

What rate would that coach go?—Nearly ten miles an hour.

Do you horse any vans?—No.

Do you run to Norwich?—Yes.

Does that come up loaded with turkeys at Christmas time?—Yes.

What is the weight of it?—When we have turkeys there is hardly any passengers; scarcely any difference; it might weigh three tons; hardly that.

You require about five hundred weight as the load for each horse?—About that.

How many miles do you reckon that a horse ought to go at that rate of eleven miles an hour, drawing five hundred weight per diem?—About eight miles.

Does the same horse do eight miles seven days in the week?—If it exceeds ten there is another horse kept, which brings it down fifty-six, and he will go fifty-six miles a week. We calculate a horse a mile; that brings eight miles to eight horses, or fifty-six miles a week. Very few coaches will average more.

You think you should be able to compete with steam-carriages; do you think you should beat them?—I fancy so. I only hope that steam-carriages will be on the high road instead of being on railroads; there is every probability of our coaches doing very well if they draw about half the weight. With a tramroad we could maintain about twelve miles an hour very easily; on a tramroad in narrow streets, where waggons or gigs are going, you will find the gig will over-run the horse.

Is there any difference in the tolls, on the roads with which you are acquainted, between steam carriages and stage coaches on any of the roads?—As far as the practical part part of steam carriages go they do not have to encounter much with turnpikes; there are very few about London; the Metropolitan Act has done away with them.

There is great variation in your tolls, is there not?—Wonderful.

What are the highest tolls on the road you go?—The highest, taking the average per mile, will differ from 9s. to 17s. 6d. on different roads.

Per mile?—Yes; per mile per month; the difference will be on the whole of the month.

Where is the highest?—On the Birmingham line of road.

Are you connected with any coaches running between Glasgow?—We do not extend beyond Leeds or Manchester.

You run as far as Holyhead?—As far as Shrewsbury.

You pay a post-horse duty besides the tolls?—We pay a stage-coach duty.

Is it on the horses or the coach?—The coach

Is there any duty on the steam coach?—I am very sorry to say there is but little paid there; I think the competition is unequal.

What is the amount of duty on the coach?—It is according to the number of passengers we take out licence for; most are rated at twopence halfpenny per single mile, which is fivepence a day; the number of passengers we are allowed to carry in each mile are four insides and eight out in winter time; if four insides and eleven outsides in summer time, we pay sixpence. Steam vessels do not pay, nor do steam carriages pay any thing to speak of. The steam carriages do on the railroad pay a trifling duty to government, according to the numbers carried; if the machine is empty they do not pay; we pay, passengers or no passengers. We have a petition before the Treasury for reducing the price of freight between Dover and Calais and Boulogne by the packets, as coaches going to Dover and Margate are obliged to pay a duty, which we cannot afford in consequence of the low price by steam, which does not pay duty.

You run the coaches?—It is difficult to reduce the number of coaches; the loading is extremely uncertain; we are obliged to keep the same number of coaches; we cannot reduce the number of coaches in consequence.

Mr. George Stephenson, C. E.

Have you turned your attention at all to locomotive carriages on public roads?—Of course I have thought a great deal about them, having been concerned in them twenty years.

What is your opinion of them?—I think they will never be made to do any good on a common road; I do not see the slightest possibility of it.

From what cause?—The friction is so much greater on a common road than on a railroad, and we find we cannot with engines beat horses used on railways so very much at slow speed, as to economy. One reason why an engine competes at a much less advantage on a common road with horse power than on a railway may be thus stated: a horse consumes no more power in maintaing his own motion in drawing a load on a common road than on a railway; whereas from the great weight of an engine, and the resistance being increased tenfold, the whole of its power is consumed in upholding its own motion.

The friction on a common road is, taking an average number, ten times what it is on a railway?—Yes; a horse will on a railway take ten times as much as on a common road, That being the case, the locomotive engine that is to go at this power is travelling on a smooth surface on the railway, but the same engine using the common road is on a very different surface. The friction is increased so very much that it has enough to do to propel its own weight without any thing else; therefore the great advantage in getting the power generated is so much less on the railway than it is on the common road that this alone makes a great difference.

You think, taking a given weight, say two tons, it would require ten times the power to propel it along a common road than on a railroad?—Yes, it would.

If you had to move two tons on a railway by a locomotive engine, what power should you find it necessary to apply to make it go at the speed of fourteen miles an hour; how many horse power?—It requires time to go into that. I will prepare that table. A horse will take ten tons, besides the weight of the carriages, at three miles an hour on a railway, and I think one ton at the same velocity on a common road. I could not tell off hand as to the exact proportions. It will require one horse power on a railway, and ten horse power on a common road.

You are well acquainted with the construction of these locomotive carriages?—I think I am; I think I have a right to say I am. I do not think there is a possibility of keeping the engine in order for any length of time from the jolting of the engine. I do not care what springs they put on.

Have you seen Mr. Hancock's carriage running?—No; I have been at Mr. Hancock's place, and saw his arrangements. I thought there was a great deal of ingenuity about it, but I told him in my opinion there was not the slighest probability of making them pay. There is no doubt of their making them go on a road, but not to make them pay, for I do not think any experienced engineer would be concerned in them. Many ingé-

nious gentlemen have turned their attention to it, but if they had had much experience in keeping steam engines in order they would not have gone into it at all. The last engine made of Mr. Hancock's construction was made by Maudslay and Co., and they are most excellent engine builders; it must be well done if they did it. I do not care how well they are done; I do not see the slightest probability of their being made to answer.

Do you suppose that Mr. Hancock's engine, if it had been running twelve months would have been running at a loss?—Yes. If I saw his books I engage to say he must have been running at a loss.

You think there is not much danger to be feared if they can be run with advantage—if they prevailed?—As to danger, that may be prevented.

There is no danger of their becoming common?—No; I do not think there is any probability; there will if full power is given to every one to use them.

If all the tolls that were laid on to stop them were taken off, you still think they would not run at an advantage?—I do.

You have said that there was a probability of obviating the dangers; state what you conceive the dangers to be?—Why, I think the most likely part of the machine to become dangerous is the boiler—the bursting of the boiler; they always endeavour to make them as light as they possibly can, and to carry as little weight as possible; they construct the boiler to carry very little water; and even if the boiler is made very strong, on account of the small quantity of water being carried, when the steam is generated that soon gets dry; if there is little water it must boil away, and there are accidents that will happen to cause them to stop. If the water gets boiled down to allow the pipes to become red-hot, hydrogen gas is generated, and explosion takes place. Explosions have taken place with these boilers; no satisfactory reason has been given how it occurred, but it has done so. I imagine that there must be a decomposition of the steam; that when the iron becomes red-hot, the oxygen of the steam will seize the iron, and of course the hydrogen is set at liberty, it is separated from the oxygen; then, if the plate is heated to a certain degree, it will take fire and explode. In the locomotive engines on the common railroad we carry as much water as will take us thirty miles.

On the railway?—Yes; my former observation is as to a common road; I am stating the difference between that and the railway. Our boilers are very large comparatively, and hold a great deal of water; the engine may stand an hour or two, and will not boil down the water; therefore there is not the same risk on a railway. More than that, we have a tank with a great deal of water to supply them in case it is wanted.

That you carry with you?—Yes. There was an explosion in Scotland from one of those, which was said to be by the breaking of a wheel. I do not see how that would make the boiler explode. I believe the boiler burst, and broke the wheel, and they merely made that excuse.

That was a large boiler?—One of the pipes, one of Gurney's construction; I think I saw it in Scotland; I saw it repairing; I understood it to be the same engine, but Mr. Russell took it up.

You saw an engine which was stated to be on Mr. Gurney's principle that had burst?—No, before this engine burst; I understood it was the same engine, if that which has been shown me was it.

Do you conceive a boiler can be constructed so small as to do the work required of it on a public road, and at the same time not to be dangerous if it bursts?—No; I think if the boiler is made very small it will not do sufficient work to work the engine forward at a desirable velocity.

Have you seen these boilers of Mr. Hancock's engine?—Yes, I have; they are merely a number of flat tubes.

The number of flat chambers is very small: if one were to burst would any evil arise?—No, I do not think there would be much evil from one of these chambers bursting; there is not that quantity of explosive matter to make the same injury; it might injure the individuals near it, but it would not do much damage.

You conceive, for security to the public, boilers must be limited in size?—Of course. I do not know that there will be any means of guarding against danger by testing the boiler, which would be perfectly safe if it was always certain that the water was always kept at a certain height, but if not there is no safety in testing; they might test before they went off, and before many miles the boiler gets too low, and the material becomes in a very different state? therefore testing ceases then to be of use.

That testing does not meet th objection you mentioned before of the hy ogen gas being generated?—Certainly not.

The only security to the public would be, that the chambers should be so small that if it did burst no injury would arise?—Certainly; each of them should be so small that it would not do much injury if it did burst.

What should be the limit of the size of these chambers?—I could not go into that without consideration.

You know the nature of Mr. Hancock's mechanism?—Yes.

Do you think there is any danger attending it?—I think there is not much danger.

Do you know Mr. Gurney's patent?—Yes.

Do you think there is danger attending that?—There is not so much danger in the tubes if they are kept small, but then you cannot generate sufficient steam.

You think there is no danger?—Yes; I think there is more danger in Mr. Gurney's than in others, for there is a greater quantity of steam held in the pipes than what is held in the chambers of Mr. Hancock's.

What is the danger, explosion?—Yes.

Do you think pipes of that size, if they exploded, would injure the passengers?—If there is a long continuation of pipes connected with it, I think that will so far hold good in Mr. Hancock's; if they are so connected that the connexion will give a free outlet from the other chambers, it is still objectionable.

Are they so?—No; there must be a connexion to get the steam generated; I do not know the size of the apertures. I know if one or more tubes gives way in locomotive engines of an inch and a half or two inches in diameter, it does not do much injury; they stop the two ends up, and go on again. I do not think they can do that with Mr. Gurney's or Mr. Hancock's.

Have you ever travelled by Mr. Hancock's or any one of the steam carriages?—No; I saw one down here, and I stopped to see it go off.

Did it make much noise?—No, I think it did not.

As much as one of your locomotive engines?—No; ours gets the steam off into the chimney; by that we get power to send us along; if they get power in the same way they would go faster on the roads. It is that jet that occasions a noise like the barking of a dog. They do make use of something in the road engines, but it is muzzled, so that the noise does not escape; they must always make use of the outlet through the cylinder to force the current of atmospheric air through the fire, but they muzzle it so that the noise is not heard. Our engines are from twenty-five to thirty horse power, and those on the roads are not more than three or four horse power. I am not quite aware, though the power may be great to begin with, it may be soon got rid of so as not to be power at all. It is not fair to calculate power by the size of cylinders. The question is, can they keep it up; if they could keep it up at the rate it set off, it would be a fair calculation to measure from the cylinder; whereas they frequently stop to allow the steam to increase the strength, then the boiler is not sufficient to supply the steam.

Do you understand that to be the case?—Yes; that one that came to Liverpool was a long time on the road, but it stopped very often.

And was assisted sometimes?—Yes.

What is the size of the chambers you make use of on the Manchester and Liverpool Railway?—They vary from one inch to an inch and a half, and others have two inches.

In diameter?—Yes.

Not larger than that?—No; the first we put up was three inches; that was the Rocket, the first swift engine; we found that we could make more steem by diminishing the diameter, and getting more (and we got more) surface, and we had them of less diameter since.

Was there much smoke from these engines?—No, I did not see much.

As much or less than the engines on the Liverpool and Manchester?—It must be the same, for they both burn coke; if they burn coke they must have the same proportions.

You do not think there is any means of diminishing the smoke?—I know of nothing better than coke; there are still fumes; a quantity of sulphur comes off.

That offends the nose, not the eye?—It has an effect on the eye also.

It surely makes a very considerable degree of smoke?—If well coked there is no smoke.

But on the Manchester and Liverpool?—Some parts of the coke is not well coked; but if it is properly done there can be no smoke from it, but fumes; there is a decomposition of the air passing through; what comes out must be different from what goes in.

Is it visible to the eye?—No; even the steam is not visible at a temperature of eighty or ninety degrees.

That is on a very hot day?—Yes.

You have turned your attention a good deal with locomotive-engines, to prevent the flying off of sparks from the ash-pit?—Yes, I have tried that, but have not succeeded in it yet.

You could not say if Mr. Hancock's is less?—If his blast is less it will not make so many sparks. I think the ash-pit may be managed; I think that may be so boxed in; it will be injurious to the making of steam, but still it will affect the engine. The freer the air gets to the fire, the more steam will be made at a less expense.

You have not done it on the Liverpool and Manchester Railroad?—They have had boxes, but they are obliged to open at one end, and when the cinders drop out they fly out of the box, and then if they come in contact with the wheels, the wheels moving at such great velocity sometimes throw it a considerable distance.

The sides of the railroad are frequently burnt?—Yes.

You have had one or two serious accidents

with fire?—That is since I left the Liverpool and Manchester.

You had one in the north, on a railroad you were concerned with, had you not?—There was a little farmhouse and building set fire to and burnt down.

Are you aware of the particular circumstances of the case?—I am perfectly sure of that being the case.

Do you know at what time the engine passed, and what speed the engine was going?—No, I do not know.

The danger of course is great with a thing of that kind in proportion to the speed at which the engine is going?—More sparks get out at a higher velocity than at a lower velocity; the draught is increased as the velocity is increased; but it is not increased by passing through the air, but by the greater quantity of steam being jetted into the chimney, which forms a vacuum. In the chimney a pipe stands up like the jet-pipe of an extinguishing engine, and all the steam that is required to supply the power of the engine has to pass out of that jet-pipe. It moves at such a velocity, it drives all the atmospheric air out, and leaves a vacuum below. There is no opening to fill up the vacuum, only through the fire, and of course we get the weight of the atmosphere to pass through the fire. In looking through the hole in the door I have seen the fire as if it was dancing on the bars, the current so strong as almost to lift the cinders, and many of them were brought out through the pipe and up the chimney.

Is there more effect of that kind in windy weather than on a still calm day?—Of course, if the wind is blowing laterally to the train of the carriages it will.

Does it make the draught more rapid?—No, it has no effect on the draught.

You have not tried to make gauze or wire covers at the top of the chimney?—Covers we have; and we have tried various sizes, so as to keep the sparks in and let the vapour out; but it has been all useless. I have tried it at various sizes till I have been obliged to take it off, the engine was so diminished in power; it was injurious to keep it on.

You saw Mr. Hancock's engine; had he any precautions of that kind?—That I do not know; I have not seen that part of his engine.

What is the usual weight you carry in one of your trains; your passenger train?—Forty or fifty tons; no, not more than thirty to forty tons, carriages and passengers together. We have engines now made that if they were travelling on a level road we could take 400 tons; they will take a large ship-load of goods at once, at fifteen miles an hour; we can make them take 400 tons on a level. I would engage to make one of 100-horse power to move on a railway; we have made them at 50-horse power, and have sent some of the same power to Belgium, and, I think, some to America.

You think that you are not yet arrived at that point that you can do any good with a locomotive-engine, effectually guarding against any sparks dropping out or flying out from the chimney?—No we have not, certainly; from all I have done and seen it has not yet got to that state.

You were understood to say according to the velocity you go those sparks were carried to a very considerable distance if they met with the wheel?—That is from the ash-pit; the sparks from the chimney are guided by the wind; if the wind is blowing longitudinally with the road the sparks do not leave the line of railway so much, but if the wind blows at right angles the sparks are carried to a considerable distance. The sparks from the chimney of a locomotive-engine are not like the sparks from a common chimney that is on fire. You frequently see a chimney on fire, and sparks come out; these have not the same tendency to ignite; they are so light that when they fall to the ground they are almost extinguished, and combustion ceases. But those that come out of a locomotive chimney have more weight in them,—they are cinders, and there is a quantity of heat remaining in them.

If there were a cap in the form of an umbrella, and they were thrown back into the chimney across, would bad consequences arise from that?—It would diminish the power of the engine; that has been tried; it was one of the schemes resorted to on the Liverpool Railroad by putting a kind of umbrella so that the sparks should be thrown downwards; and it diminished the power of the engine.

Suppose you had a lateral outside chimney, made of very fine wire, so as to carry the sparks down that, and let them fall on the ground?—I think such a covering might be made, only it would be very large and cumbersome, yet it might be made so as to prevent sparks getting out, except of very small dimensions; but it must be very large and expensive to keep up, and it would be destroyed; the free outlet of the chimney would be obstructed, and the power of the engine so much diminished, it could not travel with velocity. The sole power of the engine depends on the exhaustion of the steam into the chimney; if it was only the height of chimney, the draught, without the blast-pipe, would be so much diminished as to reduce a 50-horse power engine to not more than 2 or 3-horse power.

With regard to the power of stopping the engine on the road, in what space do you conceive you could stop an engine going at

full speed on a common road at fourteen miles an hour?—I should think from fifty to 100 yards; it depends on the weight and the momentum. The only means made use of in stopping them suddenly is preventing the wheel revolving by the application of the break, and reversing the power of the engine, so that the wheel becomes a sledge, and brings the revolving motion into a sledge motion. It is this sledge motion that takes up the momentum. It requires some calculation to know how soon. The weight of the engine must be given, and the velocity and the friction taken, to state at what distance it can be taken up; it depends also on the state of the road. If it is very wet weather it will not be taken up in the same time as if it were dry. When it is icy the sliding motion would allow the carriages to move forward with as little friction as the revolving motion, which is well known in those countries where dogs are used for drawing sledges through the snow, so that it amounts to a railway; in such cases a sliding wheel would not stop them so soon.

Do you think a weight of three tons could be stopped as easily as a four-horse coach, and in as short a space of time?—I do not think a four-horse coach could be stopped at much less than fifty yards, going at fourteen miles an hour. I think the engine would be as powerful in stopping the carriage as the horses, but I cannot conceive a four-horse coach travelling fifteen miles an hour would stop in much less distance than fifty yards. I think the horses would have a little advantage in throwing their weight against the momentum of the carriage.

How soon could you bring up an engine, travelling ten or eleven miles an hour, on a common road in summer-time?—I should think about forty yards, going at ten miles an hour. I judge from what I have seen frequently done, when a coach is called to stop it does not stop immediately.

You find great difficulty on the railroad in turning, do you not, in taking a short turn?—We do.

That is one of the points in which the system is chiefly deficient?—Yes; the power is very much diminished indeed if the curve amounts to above a certain ratio; a mile radius is the standing point we have got to; we endeavour to keep as near to that as we can. The wheels of the carriages are made conical, so that when we do come to a curve, the larger part of the wheel goes to the exterior rail, and makes up for the extra distance, so that in some degree we manage it in that way; still there is the momentum to be retarded in its progress. All matter put into certain velocity requires a certain power to change its position.

You have on the railroads things that turn to change the direction of the engine?—We have; but that engine must be in a standing position.

You never venture to turn an engine except in that way?—No.

Do you conceive that in these steam-carriages it would be possible to turn round the corner without stopping the engine?—Yes, they certainly can turn better than we can do, they have a swivel motion in the under part of the frame that they can turn it like a gentleman's carriage. It would be dangerous to have railway engines so constructed. In our engines if the wheels are left to get out of square, that is, if an obstacle is on one rail when moving at a great velocity, if the wheels are left to swing round as the wheels of gentlemen's carriages, the wheel that struck the obstacle would be retarded in its progress, and the engine would turn round and go off the road.

The difficulty depends on having the rail to run on; but it would not exist on the common road?—No; they can be made to turn on a common road something like a gentleman's carriage; but that cannot be made use of on a railroad at high velocities, from the circumstances I have stated; that is, from the construction of the engines. Neither can loose wheels be made use of; the wheels in our engines are always made to revolve with the axle-tree, so that when the wheels are made to work in a square frame they cannot change their position. If an obstacle happens to be on the road, and one of these wheels comes in contact with it, the other wheel assists in getting over it, for they all are confined to the direction of the rails. There is a contrivance I saw the other day for passing round curves, but it is by having a centre to move on, so as to change the direction of the wheels to suit the curve like a gentleman's carriage. I thought it would not do.

That would not be safe?—No; nor could machinery be attached so properly to it; we frequently, with powerful engines, connect all the four wheels together; you cannot do that if they move on a centre.

The result of your evidence seems to be, that you think testing of no use?—I do not think it is; it might be of some use; but it would not be so useful as to prevent danger from what I have stated.

And you are of opinion that there would be danger of a boiler bursting if the chamber were above a certain size?—If they are connected together; it depends on their connexion. Our pipes are not connected together; therefore it is only that one aperture which gives way, and allows the steam to escape.

In your engines you use a pipe of what

diameter?—Varying from an inch to two inches diameter.

Should you think a pipe of any larger diameter dangerous?—As it increases in diameter the danger must increase with it.

Whereabout does the danger commence?—I think at three inches diameter; I think if it gets above that it will become dangerous; dangerous at three, but still more as it increases in diameter.

You do not think any mode has been yet devised that will prevent the escape of sparks from the chimney?—I think not, not without diminishing the power of the engine.

In engines of large power?—Of course engines with smaller power will have chambers of smaller dimensions, and the same covering put in small engines will affect it in proportion as it will in the large one.

Is there any mode devised at present of entirely preventing the fall of ashes into the ash-pit?—Nothing more than what I have stated.

Without injury to the power of the engine?—I think not; not that I am aware of.

Mr. Alexander Gordon, C. E.

Thinks that he is quite an impartial person as regards the merits of the different carriages. Believes that several steam-carriage inventors say that he is partial, but as almost the whole of them say that, considers it as a proof that he is not.

Have you travelled by all these carriages that have been going?—I have travelled by Gurney's, by Macerone's, Hancock's, Field's, Ogle's, and Russell's, and others.

What speed do you think those steam carriages can travel upon the road?—I have travelled at a speed varying from two miles to fourteen, fifteen, and sixteen, and I have gone a mile at the rate of twenty.

The average rate, taking a good road without any peculiar feature belonging to it, would be how much?—Varying from ten to fourteen would be the rates at which they could travel with most profit.

And without danger to the public?—Yes; they are perfectly under command.

In what possible space can you stop one of those carriages?—Certainly in a less space than a two horse coach.

What do you conceive is the greatest capacity which is consistent with safety?—I should not like to give a hasty opinion upon that. It is a difficult subject to touch upon. I should prefer not to use a chamber larger than that now before your Lordships, and used by Mr. Hancock; nor if I were to use one of Mr. Gurney's should I use one larger than that he has at present; nor would I travel with such a carriage as Russell's boiler, which was attended with the accident near Glasgow; it had a large chamber.

You cannot state what should, in your opinion, be the extreme size of the chamber of a boiler?—If the chamber of the boiler be cylindrical, I think eight inches or ten inches at most; but I understood the question to refer to a clause in the bill now before your Lordships. In that bill there is a prohibition, I understand, of certain rectangular figures.

What is the proper shape for the chambers or compartments of boilers for these carriages, and of what sizes may they be made consistently with the safety of the public?—To transmit heat from the fire to the water in the boiler, so as to generate steam of the requisite intensity, a certain surface of the boiler, on which the fire and heated gases play, is necessary; this surface must bear some proportion to the quantity of water to be evaporated. The requisite quantity of surface was in the early steam-engines obtained on the outside of the lower portion of the boiler, which therefore required to be of large size; subsequently the boiler was diminished, and the requisite quantity of surface preserved by directing the flue through the water in a large pipe. Steam-boat boilers required to have still more of these flues from the furnace to the chimney, so that these boilers might expose the smallest weight of water to the largest heating surface. Railroad engines required a still greater proportional reduction of water to obtain lightness, and a still greater proportional heating surface; this was obtained by multiplying the number of flues through the water from the fire-place to the chimney; the flues were reduced in their size, and more of them (sometimes 150 small tubes) were caused to pass, carrying the heated gases and flame through one large chamber in which the water is contained. Such is the general description of railway boilers now in use: they have each one large water and steam-chamber surrounding the fire-place and flues; they are erroneously called by some tubular boilers, whereas they are large chambered boilers with tubular flues. The material difference between the boiler just named and the small chambered boilers of Gurney, of Dance and Field, of Hancock, and of Maceroni, and of a few others, is that the fire-place and flues in these latter form the large chamber, and the water in small chambers, in films or streams, is presented to the heat in the large oven or furnace. These numerous small chambers of water and steam are safer than the large chamber of water and steam, because the fracture of one of the small chambers does not involve the danger of an explosion of the whole. The ingenuity of the inventors is

seen in the arrangements of the tubes or chambers, so as to allow the contained water to receive its heat from the fire, and to part with its steam unmixed with liquid (i. e. dry steam) to the engines. Hancock's boiler may be considered a number of small rectangular boilers, ranged beside each other,—as books in a library,—and connected together, in each of which circulation and separation are required to go on: Gurney's boiler is a number of small tubes in the fire; water sweeps along them, becomes heated, and rising into a chamber or chambers out of the fire the steam is separated from the water, and ready for the engines, whilst the water (with or without an addition to replace evaporation) returns by another channel to sweep again through the small heated pipes. The boiler of Sir Charles Dance and Mr. Field is very similar to that of Mr. Gurney. Of the boilers which have been used on turnpike roads some are circular in the cross section of their parts, others are nearly rectangular in the cross section. The circular is known to be, according to both theory and practice, stronger than any other figure. Were it necessary I could give your Lordships numerous instances which occurred to me during many years' practice, with some thousands of my father's portable gass reservoirs, at a pressure of 450 lbs. on each square inch. The repellant and fluent particles of steam force outwards in radial lines, and their force is best resisted by hooping them in all round; the forces are then equal, and they are resisted by the absolute strength of the metal or the resisting force of cohesion. If, however, we confine steam in a square box, or other straight-sided figure, we expose the metal on the straight side of the box to another kind of strain,—the greatest strain to which metal can be exposed,—the power of the steam tending to break the metal transversely; the box is forced by the internal pressure to alter its shape, and bulges out; the metal is crippled, and fracture takes place, generally near the angle, the portions of metal on the same plane performing in some degree the functions of levers. Of the two shapes there can be no doubt the circular is incomparably the stronger. With regard to the size of chambers of such boilers as are to be allowed on the turnpike road, I think that until some means of preventing explosion, not yet known, are introduced, no cylinder of greater diameter than eight inches should be allowed in such boiler or steam-generator for the turnpike road, and no rectangular or other shaped figure of such boiler or generator shall be of more than forty-nine square inches of transverse sectional area, and no vessel or compartment of such boiler should be made in part or wholly of cast-iron. I have in this answer specified the area of the rectangular figure, which is equal to the area of the circle, eight inches diameter, not because the rectangular figure in any measure equals the circle in strength, but because if an explosion does take place the same amount of steam and water may be presumed to escape. I believe, however, the area of the fracture would in case of accident always be the largest in the rectangular figure.

Inform the committee of the weights of stage coaches, vans, waggons, and steam coaches, with the view to levying a toll on the latter; and also of the probability of steam conveyance being more general on the turnpike road or on the railroad?—Of these conveyances the most destructive to the road are the light stage coach and mail coach. In them there is a greater proportional weight resting on a square inch of the tire than there is in any of the other conveyances above stated. The difference in the rates of travelling is of less consequence; of the proportional damage done to the road surface by horses feet at a quick or at a low rate, I do not know that any experiments have been made; and in my opinion the damage done by a steam-carriage and load to the road is certainly not one-third part of the damage done to the road by the mail or stage-coach and its horses, the weights moved being in both cases the same, and, after long and careful examination and experiment, I should say, that were I the proprietor of a road I should prefer the steam-carriage, even of six tons weight, as the least destructive; and having special regard to the interests of the road-trusts of the country I say the same.

	Rate in Miles per Hour.	Average Weight in Tons, Coach and Load, without Horses.	Observations.
Mail or stage coach . . .	8 to 11	2½	Average weight of each Horse in any of these Conveyances may be stated as Ten Hundred Weight.
Van	6½	4½	
Six-horse waggon	3 to 3½	4½	
Eight-horse waggon . . .	3 to 3½	6 to 7	
Steam-carriages	7 to 14	2 Tons.—Some are much heavier. I have seen one Six Tons weight. The best amongst many that I have seen and travelled by was not Three Tons.	

Mr. Thomas Harris.

Was the engineer who superintended Mr. Gurney's steam-carriage while running for Sir Charles Dance between Gloucester and Cheltenham.

While you were running between Gloucester and Cheltenham, do you imagine that was a profitable speculation to Mr. Gurney?—I do not know; there was a great expense in establishing coach-houses and buildings, and the time was not long enough, I should think, to refund. I think we could have done very well.

Do you think the traffic on the road paid the expense of carrying it on?—Yes; it cleared it well.

Would it pay the expense of carrying it on in London?—I have not a doubt it would.

Then it is not from the extent of tolls you were prevented from doing it near London?—I believe not.

Do you know for what reason Mr. Gurney did not continue?—It was a matter of choice on the part of Sir Charles Dance.

Rev. Mr. Williams.

You can give evidence as to steam-carriages?—Yes; I have rode on them more than any person in England. I am a great advocate for them.

You are an amateur traveller in them?—Yes; and I understand something of the mechanism as well. I know something of the construction of all that were built in London.

Have you ever travelled by Gurney's carriage?—Yes.

Do you know the nature of his machine?—Yes, it is a tubular boiler.

Can it be used on roads with safety to the passengers?—The fact is, his boiler is safe, perfectly safe, but he has got an appendage to this boiler which is called a separator, or, as I call it, a danger-chamber, in order to separate the water from the steam. Within the tubes the steam forms, as it were, a corkscrew or coil, and brings out the water with the steam before it passes to the cylinder where the piston is. In order that the steam should be efficacious he has got the separators, and these are of large capacity; the consequence is, it does not signify whether the boiler is tubular, spherical, or of any other construction. If you bottle up that steam, they are all dangerous, which is the case with Gurney's; it is a dangerous boiler as long as there is a place of capacity for the steam, for if that steam is not passed off to the piston that works in the cylinder up and down, or horizontally, if you do not pass it off immediately it will burst any thing, whether it is a sphere or whatever other shape.

That separator is peculiar to Gurney's?—Yes, I think so.

You think that it is productive of danger?—Yes.

Have you been by Gurney's carriage?—Yes; several miles.

Have you met with any accidents?—No.

You trusted your life in it, notwithstanding your knowledge of the danger?—Yes; knowing that the engineer, Mr. Stone, made his valve only to a safe pressure; but suppose you come to a depth of gravel on the Cheltenham-road, eight or nine inches thick; the depth of the gravel was rather more than is usually laid by trustees on roads; it was not enough to impede a mail-coach, but it impeded his carriage, and the consequence was that they used a very great pressure there to get over, but with it the axletree broke.

Were you in the carriage at the time?—No.

You were not one of those who were blown up?—No.

Therefore danger did not occur?—No.

Have you known a case where it did occur from the boiler bursting?—Yes, at Glasgow; it was Gurney's carriage, sold to a person of the name of Ward; their carriage was in a coal-wharf at Glasgow; the person who had the management of it put on the steam, and was going to show it off to great advantage; the steam was so powerful, that either the separator or the boiler burst, and a boy or man was much injured.

Was there a separator?—Yes.

Did you see that?—Yes.

Was not that a carriage with a large chamber?—Not much larger than the usual chamber.

Was it not with a large square chamber hung under the carriage?—No; I think a cylindrical one.

But the one that burst?—Yes; I have rode on them likewise; the Scotch carriages; I have rode on it 300 miles.

But keep to Mr. Gurney's carriage; was that it? (*Pointing to a drawing.*)—No, that is Russel's; here is the boiler, which is of large capacity, and would not bear a pressure of above 35 to the square inch. I rode in this from Hammersmith to London scores and scores of times, knowing they never worked at a pressure of 20 or 25, therefore it is safe, though it is a boiler of large capacity; the safety depends on the engineers; they may blow up any of them if they load the valves to more than they can bear; but it can be prevented by a lock-up valve.

You think all steam is dangerous?—Yes; it depends on the engineer employed if he has the sole control of the valves.

You venture on board steam-packets?—Frequently; and I consider them more dangerous than steam-carriages, having boilers of great capacity, containing thousands of gallons.

Then you are an enemy to steam in general?—No; it depends on the engineer entirely; if he is fool-hardy enough to use higher pressure than a boiler can bear, no carriage is safe.

Did you ever travel by Mr. Horne's stage-coach?—Yes.

There your safety depends on the coachman?—Yes, and on the management of the horses entirely, and the coach-builder; if the axletree breaks, or a spoke or spokes break, you must come down, and most likely dislocate a limb, or lose your life. I should rather a steam-coach for travelling on, if one safety-valve is locked up from the engineer, than the best-conducted horse-coach that I know of. I do not consider boilers without the steam-chamber at all dangerous; but if they have got such steam-reservoirs, they are dangerous.

Go back to this carriage of Mr. Gurney's that burst at Glasgow; when was that?—I cannot recollect dates.

Who was the proprietor of it?—A person of the name of Ward, a man who lost a great deal of money speculating in Gurney projects, like many other gentlemen that advanced money in his concerns, to the amount, I have been told, of 40,000*l.* This is Russel's carriage (*producing a drawing*); an advocate in Edinburgh, a Mr. Dauney, a friend of mine, lost 10,000*l.* by embarking in it.

Do you know Mr. Hancock's carriage?—Yes; I have rode in them upwards of 4,000 miles; the reason why I did so was, he was continually working on all roads, winter and summer; the prohibitory tolls had nothing to do with his carriages; *he could go distances on roads where the Acts had not been renewed, the same as Mr. Gurney might have done if he had been in a situation to run.* In the metropolitan districts the Acts were renewed, and applied to steam or any other power; but the expenses attached to that are not prohibitory; it is 4*d.* on his carriage instead of 2*d.*, being double tolls in proportion to omnibuses.

Do you think the tolls were prohibitory in the other places?—Yes; but Mr. Hancock did run thrice from London to Brighton, and paid no tolls at all.

Do you think his carriage is dangerous?—No; he has no steam-chambers. An accident happened in his factory; a part proprietor in one of his carriages tied down the safety-valve with a coil of wire, so that it was impossible any thing could bear the pressure; a rend seven inches long took place; he was not hurt, but paralysed from fright, the surgeon said. There has been no serious accident from any steam-carriage of Mr. Hancock that I am aware of.

Not any whatever?—No, not on the roads, never an accident while going.

Did you ever hear of the Birmingham carriage?—Yes, but on turnpike-roads. I rode in that carriage (*pointing to Squire's and Maceroni's*), which is a very excellent carriage; I have rode from London to Uxbridge and back, to London twice; and also in Ogle's several times.

The result of your opinion seems to be, that they are all dangerous, but that no accident happens?—If the engineer is a fool-hardy fellow, it is dangerous. I have rode 200 miles in one, and I have rode in Mr. Ogle's carriage 100 miles; now his carriage is as fast as any of the carriages, and as safe; I do not think he has a steam-chamber; the boiler in his carriage is composed of a tube within a tube, and caloric impinges on the water inside and out; he generates steam as fast as the engines require it, which is the case with Mr. Hancock's. I do not think any of them are dangerous, provided the engineer is not intrusted with the key of one of the safety-valves.

Mr. William Cubitt, C. E.

You were one of the party of engineers who subscribed towards the building of a locomotive carriage by Messrs. Maudslay and Field?—I was. It originated in a sort of challenge which I gave the parties to prove the possibility of doing the thing.

What was the result of the acceptance of that challenge?—The result of it was that a carriage was built, and remarkably well built; it travelled exceedingly well, and was very manageable; *it proved that the thing was perfectly practicable,* but was not economical or expedient to be applied to the purposes of traffic.

Can you state to what extent it was not economical?—It was not economical in this respect, inasmuch as the expense of the machine and the expense of keeping it in order was too great to be put in competition with railway travelling or even with common roads. Such, at any rate, was the result, in my judgment, from the experiments we were enabled to make.

In what respect did the inexpediency of it consist; was it in travelling?—It was on account of the great cost of it.

Did you not draw a distinction between the two; expediency and economy?—I intended to say it was not expedient because it was not economical.

Has it no other disadvantage?—No; the thing is perfectly practicable; there is no difficulty whatever in making a good carriage which will travel remarkably well. We have gone up steep hills with the one we had in Dulwich and the neighbourhood, but the great cost is against it.

Is it not dangerous to the passengers?—Not under proper management any more than any other machine.

Do you mean than any other coach?—Yes.

Is it not dangerous to the people on the road by frightening the horses?—Not at all; I have been frequently through crowded roads in the neighbourhood of London, and I have never seen the horses frightened.

What was the weight of it?—Between five and six tons.

Was that as light as could be made?—It might have been made a little lighter.

Did it do much damage to the roads?—Not the least. I think if it were made properly it would rather mend the roads than otherwise, inasmuch as the wheels must be broad wheels, and cylindrical, and therefore they roll the roads.

Have you ever seen Mr. Gurney's steam-carriage?—Never.

You do not know any thing about the contrivance of that?—No. The contrivances are all on one principle; the great object is to contrive a boiler which will combine lightness and a capability of giving a great quantity of steam.

In your opinion they are not so economical as stage-coaches?—They are not so generally useful or economical as stage-coaches, because there must be an immense establishment to set them going; to run from here to Bath would require a great many locomotive carriages, and a vast establishment of workshops and stations? in fact under such management as railway carriages, which would be attended with much more expense.

What was the cost of yours?—One thousand guineas, by agreement.

What was the size of the boiler?—Our boiler was a boiler of peculiar construction; it was an assemblage of tubes, and I believe it was on the principle of what is called Gurney's boiler; at least I think so.

Who directed the form of the engine?—Mr. Field himself, subject to the approval of myself and one or two other engineers.

And you all came to the conclusion you have stated: it was an unanimous opinion, was it?—I do not know that it was unanimous; we never met to express an opinion upon the subject, nor do I know what the opinions of the other parties are; I do not even know what Mr. Field's opinion is, whose judgment I should most rely upon. I made six or seven journeys, and the result of my experience was that it was practicable but not expedient, because it was not economical.

From the experiments you have made are you satisfied that more economy could not be introduced in the management of steam-carriages,—that they could not be conducted sufficiently economically; have you made sufficient experiments to satisfy yourself upon that point?—I can only speak from the experience I have had; I doubt they could be conducted economically except upon such an immense scale as it would be impossible to establish; for instance, it would be impossible to establish a steam-carriage—to have one or two steam-carriages running from London to Bath, it would cost more than it would be worth, and they could not take passengers in competition with well-managed coaching; they could not do that but by the investment of immense capital, having an immense establishment, and doing every thing upon a very great scale. It would be necessary perhaps to have a hundred steam-carriages to keep a concern continually going.

Is not the formation of a large capital perfectly possible?—It is.

Are not railways conducted by companies?—Yes, they are; but there is not the difficulty attending the construction of a railway and the management of carriages on railroads that there is with steam-coaches; we require a totally different class of persons. In a railway a man of comparatively common talent will do for what they call the engineer, that is to manage a locomotive engine; but in managing a steam-coach it is quite different, there is the greatest presence of mind required, he should be a person of great sharpness and firmness to manage a steam-carriage on a common road; we were fortunate in having a very able man at the time we made the experiment; he was a man of the greatest nerve and spirit, and he was also a person of great mechanical skill; it made us all nervous sometimes to see him steer through a string of carriages in the way he did.

Have you ever made any calculation as to the difference of speed between what could be accomplished on a common road and what could be accomplished on a railroad?—No; but I should say I scarcely know a limit to the speed that could be obtained upon a level and good railway; I should say there is no limit till the power is balanced by the atmosphere, which would be upwards of sixty miles an hour certainly.

Mr. John Braithwaite, C.E.

Have you directed your attention to the distinction between locomotive-engines and carriages that run on the highway?—I have; not that I consider much difference between them.

Are you acquainted with the construction of any of those carriages?—My attention has been called to them, but not with regard to any particular plan; Mr. Hancock's and others, Mr. Gurney's and Colonel Macerone's, all of them have been experimentalising for a considerable time, but it does

not appear that the result has been what we should call practically successful.

As an engineer well acquainted with these things, do you imagine that the science is sufficiently advanced to enable you to build such an engine as would be both safe and sufficiently economical for general purposes?—Certainly not.

Do you think there is any danger in them?—I do not think there is any danger.

Then the objection is decidedly upon the ground of the expense being greater than the profit would justify?—I should say so most decidedly.

For what railways do you construct locomotive-engines?—At this present moment we are constructing a great many for Cuba, and we have also been applied to by the Birmingham and London Railway Company. The great difficulty is to get parties who will construct them with sufficient care and attention. Some time since I was competing with Mr. Stephenson upon the Liverpool and Manchester Railway with an engine, which was called the Novelty. It was then given as the opinion of many persons that if locomotive-engines cost as much as I asked of the Liverpool and Manchester Directors, namely 1000*l.*, that that of itself would be a decided prohibition to the introduction of steam-carriages on railways; and yet, notwithstanding that, we are now receiving not only 1000*l.*, but in many instances 1200*l.*, 1300*l.*, 1400*l.*, and 1500*l.* for locomotive-engines.

How is it that their price is not a prohibition?—From the circumstance of the great duty which the engines now do, which was never anticipated. At one time it was thought we never should do more than something like twelve miles an hour; but the result was, that we did at the rate of forty-five miles an hour.

Do any of your engines run upon that road?—No; I do not choose to build engines after a model which I know to be objectionable, unless desired as a manufacturer; and as they saddle us with the responsibility of proving these engines, which would necessarily take me a distance of 200 miles from my place of abode, it is rather too far to undertake the management of them.

Have you any carriages running on any existing railway?—Not at present; we are making several; but of course, having a very extensive manufactory, we are obliged to make for the market. We are making them upon the model laid down by the Liverpool and Manchester Railway Company,—Mr. Stephenson's improved by Mr. Berry.

Have you turned your attention to the means of preventing sparks from flying out?—Yes, I have.

Have you, in your opinion, succeeded in effectually preventing it?—No, I have not.

Have you succeeded in effectually preventing any loss of cinders from the ash-pit?—Yes; we have a tray constructed at the bottom part of the grating to receive anything that falls.

Do they not fall out?—Occasionally they may do so, when they have been stoking very furiously for the purpose of effecting particular objects, such as getting up the inclines; then they require abundance of steam, and stoke furiously; and now and then cinders fall out in spite of the greatest care.

OBSERVATIONS ON MR. EXLEY'S NEW THEORY OF PHYSICS. BY MR. BENJAMIN CHEVERTON.

(Concluded from p. 57.)

It would be more accordant with the preceding views, to classify nature in more numerous divisions, founded on the several distinct powers which may be found to exist; and though in the present state of knowledge we may err, both in the exactness of our definitions and in the number of our distinctions, it would be well to take those which at present appear to be obvious, and rely on future researches to furnish data for correction. The powers to attract, to repel, and perhaps to actuate in some particular direction, or whatever may be found to constitute the primal mechanical and chemical forces, may be referred to, as distinguishing inorganic nature; the power to control, and dispose of those forces for certain purposes by another set of laws, whose form is yet unknown, may be cited as distinguishing organic nature; the power to feel as distinguishing sentient nature; the power to perceive and will as distinguishing intelligent nature; and the power to reason as distinguishing human nature. Thus so far as real knowledge extends, universal nature appears to be homogeneous—to be one—to be power; whilst the distinctions which exist in reference to the several kinds of power, rest with an obvious certainty on the foundation of real differences between them. They may prove, it is true, to be less numerous, that those which are here assigned, but little progress, I apprehend, will be made in that philosophy, which would reduce them all to one kind, and that of the lowest grade. We shall in vain attempt to make reason the result of attraction and repulsion. We

should seek to discriminate and not to confound, and endeavour to repress that proneness consequent on limited faculties and researches, to lower the elevated things of nature down to the level of our present attainments. Instead of actively exerting ourselves to scale the yet unattempted heights, and to discover new facts and truths in a higher region of speculation, we grovel supinely among the acquirements already made, and vainly strive to expound by the things which are known, the things which are unknown. Instead of using our present knowledge as steps whereby to ascend to greater altitudes, we employ it in idle combinations and imaginative results, as a succedaneum for the arduous investigations attendant on original research: hence we assume to create for ourselves, and to make worlds of our own; we become cosmogonists and materialists, blend and confound physiology with psychology, and set up a self-intellectual idolatry, in place of sitting as humble disciples at the feet of nature. Such is the character of the opposite school of opinions from that which has previously been the subject of remark; such is the philosophy which the materialists would pass as genuine, under the guise of scientific generalisation.

The essence of materialism consists, I conceive, in making the most excellent and most exalted attributes and powers of nature, to arise from the action of the inferior powers, as though the results elicited could possibly be different in kind from the agency in operation. The conclusions that have been deduced from the doctrine of powers, are vindicated from the possibility of a charge of this kind, by the statement just made, that the several powers have an existence, as distinct and different endowments. But it may be objected by some, that as we are deprived by the doctrine in question of a knowledge of distinct and different substances, and as it is possible that all powers may inhere in one common substratum, a decided approach is made to materialism, not in the least, even on the supposition of what is here imagined possible, being actual. The common upholders of powers, it is to be observed, is unknown; we cannot conceive of its nature; no objection, therefore, on the ground of its incongruity for the support of spiritual attributes can be entertained. We are relieved from the repugnance which is felt in associating mind with solid and extended parts. Materialism is, in fact, refuted and put down, inasmuch as matter, so to call it, is no longer the matter of the materialists. The unknown substance, although supporting the material powers, may be conceived of after the same manner we are accustomed to conceive of spirit, as an individual unit, which may bear a relation to space, but of which space is not a constituent—neither is solidity. All the individuality, the intangibility the indivisibility—all the negations, in short, which are thought of in connexion with spirit, may be thought of in connexion with the unknown something which supports the material powers; for matter is rescued from the inert condition, which solidity and extension, considered as essential qualities, imply, and is endowed with the energetic attribute of power. Activity becomes its very essence; its properties are no longer incongruous with spirit, and therefore the conjecture of their identity in substance may be entertained without disparagement to the latter. The conjecture does not degrade the spiritual essence by assigning to it solid extension, but it dignifies the material essence by withholding such qualities from it. These views, therefore, of a oneness of substance for all powers, are as much opposed to materialism, as they are to the opposite doctrine; they lead, in short, not to the materialising of spirit, but to the spiritualising of matter. But, in truth, we have no concern with these topics, and conjectures in any direction are idle, and altogether gratuitous, for we possess no data from which to proceed. The point would not have been discussed, but that it is desirable to avoid opprobrium and to obviate misconception.

There is one other point which also requires a brief explanation. This doctrine of powers, distant as it is from materialism, is equally far removed from the idealism of Berkeley; for that philosopher, whilst he denied, as is here done, the existence of essential or primary qualities as different from secondary qualities, contended, that the powers external to us, designated by the term matter, is in truth the immediate action of the Deity, regulated by laws, and manifested to us in the same manner, as though there existed an intervening substance in possession of those powers,

and governed by those laws. He thus dispensed with matter as a real existence; but it should be observed, that he did so, only in reference to its substance or substratum. He did not imagine that we are perpetually the subject of mental illusions, as is commonly supposed, but he considered that the powers of nature so called, have a real existence as the emanations of divine power, but unconnected with any intermediate substance. Such alleged substance being unknown; the supposition of its existence he thought to be unnecessary, if it were not allowed to possess any powers of its own. The acknowledged substance of spirit he admitted to be equally unknown; but then this class of powers, is allowed an existence distinct and separate from, though not independent of, the Deity; and hence arises a cogent reason for the existence of a substance in which they may inhere. His system of idealism, followed, therefore, very rationally and consistently from these premises—that the substance of matter is not an object of knowledge; and that the powers of matter are manifestations of Divine energy. The first doctrine, if he did not originate it, he was the first most successfully to establish. The second doctrine was, and still is, the prevailing belief among philosophers. Could he have emancipated himself from the trammels of this belief, he would have acknowledged that substance, though unknown, exists as a support of material powers, as well as that substance though also unknown, exists as a support of spiritual power.* He would then have stood on the very ground which is taken in this paper. Here then is the difference between idealism and the views now inculcated. But waving the argument in favour of the existence of the substance of matter, as arising from the necessity of a substratum to uphold powers which are not divine, let us refer to one more immediately based on induction and experience, to prove the reality of distinct and separate existences in the constitution of external agency.

* That a substance knowable to finite creatures, that solid extended *matter*, is the support of *divine* power; that it is in any manner required to be in connexion with it, is a hard proposition for philosophy to digest, and savours more of Spinozaism than is suspected.

It is impossible to divest ourselves of the consciousness that we exist as a substance, or as a something distinct from our powers, which ceases not to exist when those powers are inoperant, and which unites and comprehends them all in one active and sentient being. We thence argue, when brought by experience to perceive that there are in existence other numerous powers, or rather groups of powers, like unto our own, that they also must belong to substance and to individual substances—I mean that those powers cannot be referred to only one originating cause. Herein I beg it to be observed, lies the gist of the further argument; the point is this—that there is the same reason and the same certainty for referring those external powers to *many* causes, as there is to *any*. In short, we are entitled, with the utmost confidence, to infer the existence of other powerful beings like unto ourselves. Thus far Berkeley would also have proceeded. But may we not further argue, with the same certainty, because the self-same process of reasoning is adopted, that when brought by experience to perceive, that other powers again, of a different and inferior kind, exist, which produce the impressions of heat, colour, solidity, &c., may we not infer, not only that these powers also must own an external cause, but that they must belong to substances as individual existences. It is not enough to infer merely an external cause, for the idealist will retort; that he also makes such an inference, when he ascribes the production of those impressions to the immediate agency of the Deity; but we ought to infer, what we are equally warranted to do as in the former case—that the external agency is *many* and individual, having respect to distinct substances; and this conclusion, carrying with it the necessity of a plurality of separate acting causes, precludes the idea of the sole agency of the Divine Being, which of course is *one*. Thus, our belief in the existence of matter, rests on the same ground whereon we persuade ourselves, that there are other intellectual beings in the world besides ourselves. This belief reposes not on the evidence of sense, for that carries us no further than the existence of the sensation; but on an inference, which is the dictate of intelligence, in-

tuitively, or, if you please, instinctively, suggested.*

By adopting the views which have been now unfolded, we shall cease to obtrude on either hand, those magisterial dicta which distinguish the opposite schools of dogmatism and assumption. We shall drop our pretensions to a knowledge of things which are beyond our reach; for what purpose, or by what party soever, it may be taught, and humbly confess, that we ourselves and all things around us are shrouded in impenetrable mystery. We shall ingenuously acknowledge, that we know nothing of *essence*, and that our true province, indeed our only ability, is to thread the labyrinth of the complicated effects of modifying powers, and to trace those powers truly, until we may arrive at their primal and simple forms. There we must for ever stop. The history and the progress of philosophy—the direction which its successful inquiries have taken—the analogies of science, its universal tendencies to quantitive results, and the peculiarities of the sensations themselves, all tend to create the belief, that the impressions referred to solidity, own no other cause than *force*. This conclusion would obtain a more ready assent, but that the mind clings to the notion that there is something else besides force, as being necessary to uphold it. Undoubtedly there is something, though it is impossible for us even to conjecture what it can be, for the vision, therefore, hath not impressed the sense, nor the similitude thereof entered the mind. It is, however, to that something we are prone to attribute the actions upon us, instead of attributing them to the forces which it acts; and the mind, unsatisfied with the rude idea of force, eagerly avails itself of some of its own affections, wherewith to clothe that something—to acquire a conception of it, to confer on it a substance and a form. But force, naked force, is all that by the present constitution of our nature, can pass from it to us. If the refined sensations of vision fail to disclose to us any thing of its essential nature, it is in vain to imagine that the grosser sensations of touch will unfold to us more of its secrets. We are entitled to demand of a philosophy which shall teach us otherwise, its proof, that any of our sensations are coincident with, or characteristic of matter; we inquire, what right has it to turn these, our mental affections over to matter, and make them qualities thereof; and we require to know, what criterion it can point to, what guarantee it can offer; that as, in regard to some of them, it has confessedly gone astray, it is in its conclusions respecting solidity and extension, infallible.

The progress of knowledge has ever been in this direction—to narrow the bounds of legitimate inquiry, though, at the same time, to render investigations more definite and more exact. Already has philosophy moderated its pretensions to the point of acknowledging, that we know nothing concerning the efficiency of causes; and that our only object of discovery, is the invariable connexion of events. Why, then, should it persist any longer in the yet bolder pretension, that the nature of matter is open to observation, and that we do obtain an insight into the very source of the efficiency of causes, an access to the origin and fountain-head of power? Let us abandon this presumptuous thought, and thenceforward will cease those bitter animosities which have been engendered by differences of opinion on some points connected with this subject, and which it is lamentable to think, have arisen on both sides, from a misconception as to the limited extent of our reasoning and discerning powers. Doubtless the time will come, when we shall cease to insist that our knowlege of spirit and matter is so determinate, as to entitle us to decide, either on the one hand, that they are distinct and different essences; or, on the other hand, that the primary qualities of the latter, constitute the substance from which, in some of its modifications, result the attributes which are usually assigned to the former. In the day, when metaphysics shall have abandoned the high and long occupied ground of *à priori* reasoning—when it shall have come down from the region of pure intellect, and taken the humbler walk so successfully trod in physics—the walk of observation and just inferences; in that

* I have here found an argument, or rather have analysed an operation of the mind, which enables me to reject with greater confidence the hypothesis of Berkeley, than I did in my former paper. I hope the argument will be found to be valid, notwithstanding that it has been often said by those who were not the friends of idealism, that it cannot be *proved* to be false.

enlightened day of metaphysical discernment, we shall ingenuously acknowledge, that of aught beyond the effects and manifestations of power, we are in utter ignorance, and that the secret of its source and nature is inscrutable.

We have now taken a review of some of the consequences which logically and irresistably follow, from the doctrine involved in Mr. Exley's "Theory of Physics," and in many other theories and statements besides. The reader must have perceived, particularly from the tone of my latter remarks, that my own opinion is decidedly in favour of that doctrine. The truth is, that it is coincident with propositions which I have myself advanced in my former paper. I there affirm that "properties or qualities are certainly only the different manifestations of power, as severally operating upon us through our senses; and it is of this power only, in its varied forms, as affecting us through the several mediums of access, of which we can be sensible or have any discernment." This is fully equivalent to Mr. Exley's assertion, that "we know nothing of matter but by the forces which it exerts, and which, doubtless, constitute its nature," or rather its essential properties. The difference between us, lies in the circumstance merely that our respective premises have different conditions. The metaphysical truth is the same in both, and is, as I consider, absolutely certain, though its physical form is, I contend, only probable. Whilst, therefore, I am content to speak indefinitely of the primary powers of matter, because, confessedly, unacquainted with their form and law of action, Mr. Exley aspires to an exact knowledge of these arcana, and to give so definite a statement of the forces and their laws, as to be able to ground thereon a general theory of physics. Disagreeing as to the sufficiency of proof which he advances in behalf of his system, we agree in denying the validity of the distinction, between the primary and secondary qualities of matter, and in resolving *all* our knowledge of matter into a congnizance of its powers, as capable of impressing us with various sensations; or, in his own language, that "matter is perceptible to man by means of its powers acting on the senses, which evidently in infinite wisdom, are adapted to receive the impression of these powers." Mr. Exley considers the principles of his system to be undeniable, whilst I can only regard them as uncertain and hypothetical, though not devoid of some probability. Nevertheless, this theory has a useful bearing on the metaphysical propositions and inferences which have been advanced, inasmuch as it shows, even in a physical aspect, the probability in the possibility, that certain original powers of matter excite those sensations which we usually attribute to qualities in bodies; and this it does, by pointing out their sufficiency for that purpose, and the manner *how* such an effect may be brought about. By placing before us a physical *modus operandi*, it presents us with one conceivable form, by which such a state of things may result, which metaphisical considerations teach us does really obtain. I would therefore state, in further explanation, that I was desirous that the conclusions which I have drawn, especially those which render some long-cherished distinctions futile, should be deduced rather from the first principles of a physical theory, than from my own more metaphysical propositions, although in the present imperfect state of the former, the conclusions derived from the latter possess a higher authority; still, I thought it exceedingly desirable, to draw closer together, and to connect, if possible, though it should only be by a link of probable truth, the investigations of physics and metaphysics. Allow me to add, that though opinions adopted in earlier life, have, on this occasion, revived with augmented force, I have felt more disposed to affix them as consequences to another man's principles, than to advance them on my own unsheltered responsibility. I fear, however, that Mr. Exley will not feel flatter by this putative paternity, and that the new views of things, which his principles, when carried out, disclose to us, are not exactly those foreseen or contemplated by him.

I am, Sir, yours, &c.

BENJ. CHEVERTON.

A NEW QUESTION. BY O. C. F.

It is well known, that if a person buy 120 eggs at 2 for a penny, and 120 more at 3 for a penny, and sell the whole

at 5 for twopence, he will lose *fourpence* by the transaction. Now, supposing he had bought 120 at 2 for a penny, how many must he buy at 3 for a penny, so that, selling the whole at 5 for twopence, he may neither gain nor lose? And, again, supposing 120 bought at 2 for a penny in each case, how many must be bought at 3 for a penny, so that on selling the whole at 5 for twopence, there may be gained 10 per cent., 15 per cent., and 19 per cent., respectively? And, lastly, is it possible, having bought 120 at 2 for a penny, to buy *any* number at 3 for a penny, to sell the whole at 5 for twopence, and gain *twenty* per cent.? If it is *not* possible, what is the reason?

This simple question is proposed in order to illustrate the nature and cause of a limit which sometimes occurs and excites surprise in inquiries relating to percentage gains.

MR. MACKINTOSH'S FIFTH LECTURE ON THE ELECTRICAL THEORY OF THE UNIVERSE.

Mr. Mackintosh remarked, that men had divided the physical sciences into several branches for the convenience of study; but if we desired to obtain a complete view of the subject, we must put all the parts together, and view nature as a whole: in this sense, we should find that geology and astronomy were intimately connected, and that the study of the one would reflect light upon the other. In connexion with the electrical theory, there were two points to be established—first, that the earth was contracting into solid rock; second, that solid matter in large masses has been deposited upon the surface. With respect to the first point nothing more was required than to state the fact that the hardest rocks contained remains of animals and plants, which once lived and died, and were deposited upon the *surface* of the earth, but their remains were now found hundreds of feet *beneath the surface*. It thus appeared, that the surface of the earth was raised in many places hundreds, and even thousands of feet above the original surface; and this fact, alone, was sufficient to convince us of the deposition of matter upon the earth; but if any further proof were wanted, we may find it in the additional fact, that the stratified rocks were found in positions into which it is impossible they could have been thrown by a force acting from beneath, they must have been deposited in a solid state upon the surface.

The details of the geological arguments connected with the electrical theory of the universe will be found in No. 655 of the *Mechanics' Magazine*, which renders a more lengthy report of this lecture unnecessary.

NOTES AND NOTICES.

Stage-Coaches were first introduced into Scotland in 1678. On the 6th of August, in that year, the magistrates of Glasgow contracted with William Hume, of Edinburgh, that he should run a coach between Edinburgh and Glasgow, — forty-two miles. Hume engaged with all diligence to run a coach with six able horses, that should "leave Edinburgh every Monday morning, and return (God willing) every Saturday night!"

French Steamers.—A grand French enterprise of steamers in the Mediterranean is nearly completed. Ten of them, each 500 tons, and magnificently fitted up on English models, are in the port of Marseilles, ready to commence the service. There are to be two lines, one from Marseilles to Constantinople, the other from Athens to Alexandria. They will intersect each other at the little island of Syra, and exchange passengers and dispatches. Between Marseilles and Constantinople they will touch at Leghorn, Civita Vecchia, Naples, Messina, Malta, Syra, and Smyrna. The departure will be so managed that three times per month three steamers, one coming from Marseilles, the second from Constantinople and Smyrna, and the third from Alexandria, will arrive at the central station at Syra; so that a person at Marseilles can receive on the 29th day an answer to a letter written to Constantinople or Alexandria; while at present forty-five or fifty days are employed in going and returning between Marseilles and either of those places.—*Sunday Times.*

Paddle-Wheel Experiment.—A recent experiment has proved that the supply of water to the paddle-wheels of steam-vessels does not come from the surface of the water, or from the sides of the space through which the wheel moves at each evolution of the water, but from beneath. It was proved as follows:—A steam-vessel was moored at deep water, which was strewed (it being calm weather,) with sawdust; the engine was then put in motion, and it was observed that the sawdust all around and every where, except immediately behind the paddle-wheels, remained undisturbed.—*Times.*

Transferring Plants.—An interesting improvement in the mode of transferring plants which thrive best in a humid atmosphere has recently been communicated to the Society of Arts. They are merely planted in a box filled with moist earth, and covered with a glazed frame, rendered as air-tight as possible. Captain Mallard, R.N., filled several cases with ferns and flowering plants at Sidney, some of which had not previously been introduced into England. The thermometer, when the plants and flowers were placed in the case at Sidney, stood at 90 and 100. In rounding Cape Horn, about two months after, the thermometer was observed as low as 20, at 8 p.m., and the decks were a foot-deep in snow. A fortnight after, they were in the harbour of Rio Janeiro. In crossing the Line, the thermometer rose to 120, and on the arrival of the ship in the British Channel the thermometer was as low as 50. The plants were not watered, and received no protection either by day or night, and yet were found in the most flourishing condition after eight months' confinement.

Rock-Blasting by Lightning.—Perhaps human ingenuity and daring were never more strongly

manifested than in a recent instance in Prussia. In order to get rid of a large rock, the expense of removing which, by ordinary means, would have been enormous, a deep hole was bored in it, into which was fixed a bar of iron, 28 feet high, for the purpose of attracting lightning. The experiment was successful. On the first thunder-storm, the rock was shattered into fragments, which, of course, were easily carried away.

Colossal Statue of Shakspeare.—Dr. Carpue lately at the Western Literary Institution, Leicester-square, stated to the audience that he had an important communication to make on the subject of a statue to Shakspeare, the largest statue ever erected to an individual. The King had consented to be the patron, and the Queen the patroness of this plan. The statue to be raised on an elevation 200 feet above the level of the Thames. The pedestal to be 60 feet, and the statue 80 feet high. It was also projected that there should be a staircase by which the curious might ascend to the crown of Shakspeare's head; that there should be built near the statue a house, a *fac-simile* of that in which it is assumed Shakspeare was born, for the residence of the person who should be engaged to show the statue; and that such residence should be allotted to a female descendant of a sister of Shakspeare now alive, but who is in very humble circumstances, and who should also derive any benefit that might accrue from showing the statue. He further mentioned, that the expense would be 20,000*l.*, to be raised by subscription; but that no one was to subscribe more than one guinea. For such an object, and that was to be so productive of immediate benefit, he doubted not that there would soon be an adequate amount of subscriptions. The communication, after surprise had somewhat subsided, was greeted with very enthusiastic applause. The Doctor did not say how the descendant of the Shakspeare family was in the interim to be taken care of, nor did he mention when the projectors and calculators expected that his colossal statue might be completed.—*Morning Herald.*

Improved Thatching—The Somersetshire mode of thatching is preferable to all others. It consists in using unbruised straw, provincially called reed, instead of bruised straw with the ears on it. The practice of Devon, Dorset, and Somerset, in this respect, is an example to all England, which we are surprised has not been more generally followed, as it lasts nearly a long again as common straw, and does not offer the temptation arising from grains of imperfectly thrashed corn, which induce mice and birds to infest the dwelling and make holes in the thatch. The mode of preparing the straw is simply to take a sheaf of wheat and to place it in a reed-press, made of two pieces of timber ten feet long, put on a stool, and having women to lay hold of the ears of corn, who draw out the straw and cut off the caps, and then bind up the sheaf for use. In this process women are usefully employed in wet weather, and the corn is much more easily thrashed when in short ears than when encumbered with the straw. The thatching work done with the reed will last ten years longer than that done with the common straw, and as to the appearance there is no comparison; one is an elegant neat covering, and the other a slovenly ragged one. Many gentlemen possessing fancy cottages and rural habitations have been so struck with the neat and picturesque appearance of the cottages in the three Western counties, as to have sent for persons to prepare reed for them in the counties where their dwellings are situate.—*Farmer's Magazine.*

Another "First" Inventor of Steam-Boats in America.—A writer in the *Philadelphia United States Gazette* claims for Rumsey, of Virginia, the honour of first propelling boats by steam in this country. It was many years before Fulton, and Rumsey was considered a wild enthusiast. With the assistance, however, of a drunken blacksmith at Shepherdstown, he constructed a boat which went up the Potomac against the current at the rate of half a mile the hour. The Legislature of Virginia granted him some privileges, it is said, which his poverty prevented him from embracing. He afterwards went to England, where he was patronised, but died suddenly, leaving his family in indigence—the usual melancholy fate of those who have enriched the world with their genius. But as to the matter of priority in the great invention alluded to, we believe it is pretty well ascertained that the first experiment in this country which had any thing like the merit of success, was by Fitch, on the Delaware river. The periodicals of the time contain a sketch of the boat, and an account of the experiment. Lieutenant Stidell, however, in his excellent work on Spain, found, in the Archives of Barcelona, authentic evidence that experiments in steam-navigation were successfully attempted in that harbour *several centuries* since. To the indolent and voluptuous Spaniard, therefore, and neither to learned and enlightened England or France, we are indebted for the first conception of this immortal invention. (!)—*New York Evening Star.*

Beetroot Sugar.—A refinery of sugar from the beet-root is being erected at Thames Bank, Chelsea, which it is expected will be in operation in about six weeks. In the vicinity of the metropolis, during the past summer, a great many acres of land have been put into cultivation with the root—at Wandsworth and other places. The machinery will be principally on the plans of the vacuum pans, and a pure refined sugar will be produced from the juice by the first process of evaporation, after it has simply undergone the process of discolorisation. Another part of the premises is appropriated to the manufactory of coarse brown paper from the refuse, in which it is extensively used in France. In case the government do not interfere, and, by rendering the product exciseable, retard or prohibit its manufacture, several individuals have it in contemplation to establish refineries in different parts of the kingdom for purifying sugar, which may be produced in agricultural districts for domestic or individual use. A refinery has lately been established at Belfast, in the vicinity of which town upwards of 200 acres of land have been put in cultivation with the beet root for the manufacture of sugar.

The publication of the Supplement to Vol. XXV. is unavoidably postponed until the 1st of December.

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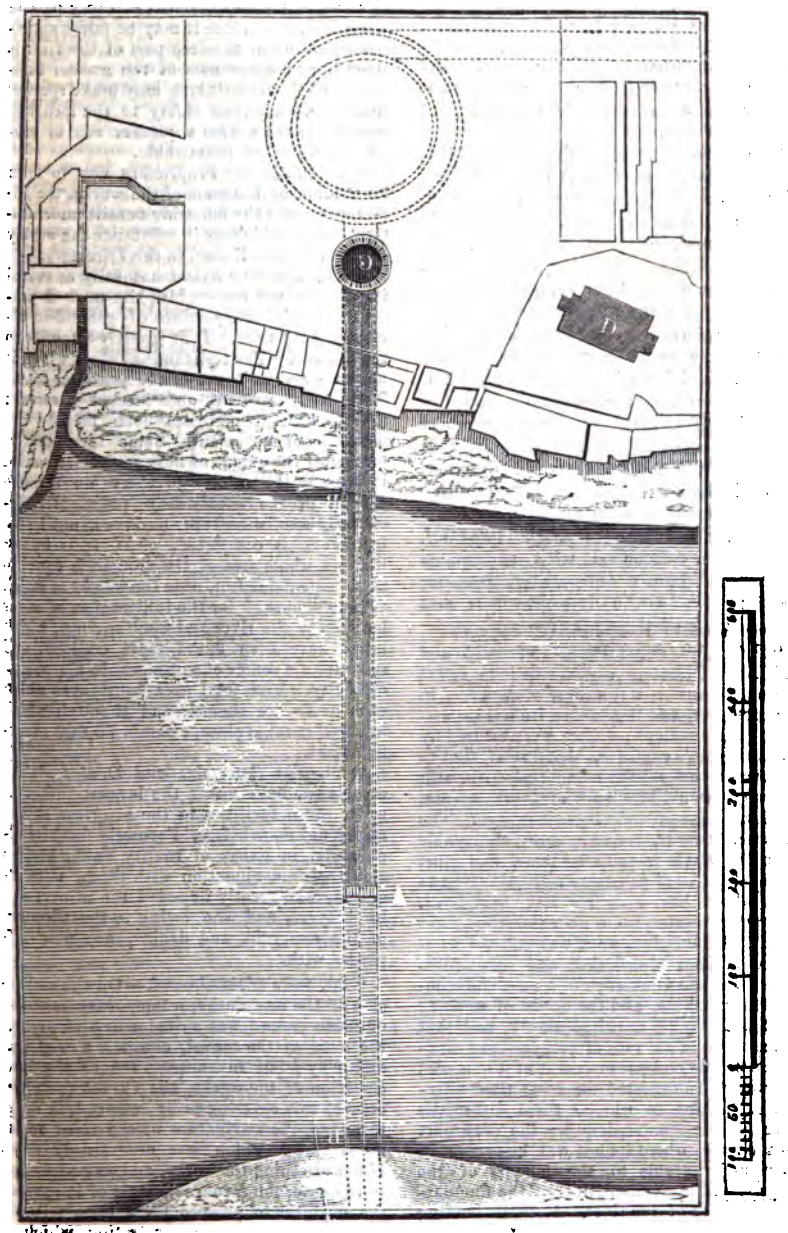
PROGRESS OF THE THAMES TUNNEL.



PROGRESS OF THE THAMES TUNNEL.

As there now appears to be some likelihood of the completion of Mr. Brunel's "great bore," we have thought that a statement of its late progress would be interesting to our readers; we, therefore, subjoin the substance of the last Report of the Directors to the hope-sick Proprietors, at a meeting held on the 7th of September last.

The Directors state, that since Midsummer last, "60 feet of the brickwork of the tunnel have been completed, which added to the quantity previously finished, makes a total of 660 feet. By this addition the tunnel is now carried beyond the centre of the river, and is steadily approaching the Wapping shore."

After reminding the Proprietors that the stoppage in 1828, "was occasioned by no difficulties of an engineering nature whatever, but solely on account of the original capital of the Subscribers being exhausted," and "that at that time about 599 feet out of 1,300 feet, which is the extreme length of the horizontal roadway and the shaft, were completed for the sum of about 120,000*l.* only"—they proceed with statements more immediately interesting, because they relate to the late progress and present state of the works:—

"In their annual Reports of 1835 and 1836, the Directors endeavoured to guard against an undue expectation of progress in the first year, and they did so from three distinct considerations:—They were assured by the Company's engineer, Mr. Brunel, that to remove the old shield and to replace it with a new one would be a work of great expense, of slow progress, and of great danger. The expense, however, is one properly chargeable upon the whole work to be done, and must not be considered as exclusively belonging to that which has been recently completed. They were aware also from experience, that when this hazardous work was effected as it was with unexampled skill and presence of mind, that the knowledge of a vast and complicated machine, and the mode of working it, could only be acquired slowly, and that hence delay in the rate of progress was incidental to the recommencement of the works, and was to be expected for some time afterwards. Added to which, these difficulties were to be encountered under the deep part of the river, where its bed was known to be most unfavourable to the labours of the miners, and most susceptible of the fluctuating influence of the tides. Notwithstanding these difficulties, the tunnel has advanced to the extent already mentioned; and though they have retarded the progress of the work, yet the miners have acquired both confidence and familiarity in the discharge of their duties and in the management of every part of the shield, and hence it may be fairly anticipated that when the deep part of the river is passed, and where none of the greater difficulties of the undertaking may make speed of less importance than safety to the men and security to the works, a quicker rate of progress will become practicable.

"To enable the Proprietors now to form an opinion of the state of the works, the Directors submit the following details under distinct heads, which are in substance the weekly Reports of Mr. Brunel to the Directors:—

"1st. *The New Shield* has fully answered its purpose, and has enabled the work to proceed through some portions of ground in almost a fluid state. It is greatly superior to the old one. The resistance against which it has to exert its power is computed at about 3000 tons, vertical and lateral pressure; nevertheless, it possesses both facility and precision of movement. Some idea may be formed of the extent of the excavation which it enables the miners to carry on through ground of the consistency previously described, and which it preserves until the brickwork is completed, when it is known that the whole area of the ground is equal to 2000 superficial feet, over the whole of which vents are opened for the infiltration of water both from the river and land-springs, which latter have been found most copious, and sometimes a source of considerable alarm and difficulty. The total area from over which such vents are opened, and through which infiltration takes place, exceeds 75,000 superficial feet.

"2d. *The Reservoirs and Drains*, lately completed, have under the largest influx of water given facilities to the progress of the miners unknown before. Formerly forty hand-pumpers, in gangs of twenty each, besides artificers in conjunction with them, were required, who greatly impeded the miners and bricklayers, and who, owing to the adoption of the reservoirs and drains, are now dispensed with.

"3d. *State of the Ground.*—On the suspension of the late works, a temporary covering of made ground was raised over and around the head of the tunnel, consisting of gravel and clay; but in consequence of the long cessation of the works, the City Authorities ordered this covering to be removed, in order to restore the navigation of the river to its usual state, which was accordingly done. Upon resuming the works, and on examining the ground, the favourable state of it enabled the engineer to proceed for a time without again resorting to the protection which it

afforded; it was, however, thought prudent to obtain from the Lord Mayor permission to resort to this plan when necessary, as a precautionary measure against the great influence of the tides whilst the tunnel is being constructed under deep water. The influx of river-water is discovered by its temperature, as well as by the increased quantity pumped up by the engine, and it is found invariably that a timely resort to this expedient immediately reduces the quantity and brings it under control. The precaution is, therefore, one essential, in the opinion of the engineer, to the security and progress of the works.

"4th. *Rate of Progress.*—Since the annual meeting, 60 feet of brickwork have been completed which, added to the 10 feet (always occupied by the shield) excavated, makes a total of 670 feet, notwithstanding the difficulties which had to be encountered on the resumption of the works, which have been already alluded to in a former part of this Report. As the tunnel approaches the opposite shore, the difficulties of the undertaking will decrease. The thickening of the crust of earth, or the bed of the river over the head of the miners, will render the more rapid advance of the shield perfectly practicable; and as the works will then be carried on under shallower water, they will be less influenced by the tides.

"In a Report made on the 24th of August to the Directors, Mr. Brunel says, 'Contrasting our present state, however, with almost the whole course of June last, it will be seen that we have gained considerably in every respect. On many occasions in June we were obliged to block up and timber the top boxes, and even to suspend our proceedings until we could approach, as it were, the top polings and probe the ground; but since and from the auxiliary means which I adopted on the 2d of July, and made an application of on that day, not one single instance is recorded of the boxes being blocked up, or of ground breaking in; on the contrary, the ground which could not be worked before, and wherein a pricker entered seven feet ahead, was worked with perfect security. We may anticipate that we shall gradually improve in progress.' The auxiliary means alluded to in the foregoing Report, and which can only be generally described, consist of a system of pinning and isolating a portion of ground, which is then removed without disturbing the contiguous portion from which it is taken, and which has enabled the work of excavation to proceed under the most formidable circumstances. This system, combined with a mode now adopted of at once conveying away the land-springs and directing their course to the reservoirs, instead of attempting to stop their influx, has enabled the miners to proceed where difficulties have appeared at first almost insuperable.

"In Mr. Brunel the Directors continue their unabated confidence, and, in conclusion, whilst they remind the Proprietors that the work is one not yet free from both uncertainty and danger, they still desire to reiterate their opinion, that at no very distant period this great undertaking will, inspite of opposing difficulties, be completed, and a communication made between the shores of one of the deepest parts of the river, where within a small space the trade and navigation of London may almost be said to be concentrated: and that, in all probability, this communication will be made at less than halfthe expense of any communication for similar purposes within the range of the metropolis.

"(Signed) BENJ. HAWES, Chairman.
"Sept. 7, 1836."

Our front page engraving illustrates the progress of the works. The dark part of the tunnel is that which is finished. A, the position of the shield on the 7th of September, 1836. The light part, with dotted lines, shows the portion remaining to be done; B B are the low water-marks; C, the Rotherhithe shaft, for the entrance of foot-passengers to the tunnel; the dotted circle shows the more gradually descending roadway for carriages and waggons; D, St. Mary's Church. The part of the tunnel from low water-mark to the shaft on the Wapping side of the river (about 350 feet,) is not shown in the engraving.

THE NEWTONIAN PHILOSOPHY.

Sir,—Indisposition has prevented me from sooner fulfilling the promise I made at the conclusion of my last letter.

Mr. Mackintosh objects to Newton's first law of motion, namely, "Every body continues at rest, or in uniform rectilineal motion, unless affected by some mechanical force."

Mr. Mackintosh is not the first who has objected to this law; hundreds of others have done the same, and thousands of pages have been written on the subject—from the days of Toland (one of Newton's bitterest opponents) to the present time. It has been urged, that if we grant the truth of the Copernican and Newtonian description of the planetary motion, then we admit there is no such thing as rest, or uniform rectilineal motion. Nor has Newton himself any where asserted, that there really exists in nature such a thing as absolute rest, or a continual and uniform rectilineal motion.

Let it be remembered, that he has introduced a limitation in the above law, "*unless affected by some mechanical force.*" The nature of such forces he has duly considered in his immortal "Principles of Natural Philosophy." He might, perhaps, have been induced to assert the truth of this law, or axiom, or principle, by knowing that the planets have continued for ages, or as far as observations can be traced, without the smallest perceptible diminution of their motions; and if at any point in their orbits the forces that regulate their motions were supposed to be decomposed, that representing the centrifugal force would produce uniform rectilineal motion. But to do away with the idea of uniform rectilineal motion, would be a source leading to continual blunders.

Professor Robinson, after enumerating and answering the objections that have been urged by a certain class of philosophers against the soundness of Newton's first law, thus concludes:—

"All these differences of opinion may be completely settled by adhering to the principle, that '*every change is an effect.*' It is a matter of fact that the human mind always considers it as such. Therefore, the law is strictly deduced from our ideas of motion and its causes; for even if it were essential to matter gradually to diminish its motion, and at last come to rest, this would not invalidate the law, because our understanding would consider this diminution as the indication of an essential, or, at least, a universal property of matter. * * * We should ascribe it to a natural retarding force, in the same way as we give this name to the weight of an arrow discharged straight upwards. The nature of existing matter would be considered as the cause, and we should estimate the law of its action as we have done in the case of gravity; and, as in that case, we should still suppose that were it not for this particular property, the material atom would continue its motion for ever undiminished," &c.

But let Mr. Mackintosh point out any proposition in the *Principia* depending on this law, and show (if he can) that it is inconsistent with facts deduced from astronomical observations.

Mr. Mackintosh accuses me of attacking the electrical theory with more asperity than appears to him to be needful. He may think so, but I judge otherwise. Indeed, I would have acted exactly in the same way had Mr. Mackintosh been my own father, or brother, or son. I have paid no small degree of attention to the Newtonian system; and I am free to confess, that the more I study it, the more I become satisfied of its truth. And as I find so many parts of the electrical theory opposed to that of universal gravitation, I think that, as an old correspondent of the *Mechanics' Magazine*, I would have neglected my duty had I allowed the subject to pass unnoticed; nor had Mr. Mackintosh any right to suppose that such would have been the case.

Mr. Mackintosh's method of accounting for the diurnal motion of the earth by means of galvanic circles and electrical currents, &c. puts one much in mind of the whirlpools and vortices of Cleanthes and Descartes, and the celestial machinery of Eudoxes and Callippus. These philosophers placed the whole of their celestial mechanism in the heavens, where they had some chance of being seen. Mr. Mackintosh, with more circumspection, has entombed his under the surface of the revolving planet. Now, if we could force ourselves to believe in Mr. Mackintosh's theory, we must admit that the Supreme Architect himself is unacquainted with eternal or perpetual motion, for notwithstanding all the care he has taken to preserve the rotary and revolving motions as long as possible, still both must come to an end, and the "earth cease to revolve upon her axis." Mr. Mackintosh, in fact, tells us, that the rotary motion of the moon has already ceased! (No. 645, p. 233, 234.) It is strange (if true) that none of our astronomers have thought proper to give us any information of this astounding fact; or has Mr. Mackintosh merely made this assertion for the purpose of trying how far he could play upon the credulity of some of his readers (friend Ursa for one)? Or it may be (for I would not wish to deal harshly with him), that he had not duly considered the subject when he made this strange assertion. But be that as it may, let any one contrast this fanciful part of his (Mr. Mackintosh's) theory with that given by Newton, and let him say which is most probable. Newton requires no complex machinery to demonstrating the rotary and revolving motions; all that he requires are the figure of the planet, and a proper application of gravity, and all this is fully borne out by testing his theory with sufficient and modern observations. Thus, for instance, the length of the day has

neither increased nor diminished by the smallest fraction of a second since Hipparchus (the father of practical astronomy) observed eclipses nearly 3000 years ago. I have still other remarks to make on the electrical theory, but these I must postpone for another communication.

I am, Sir, yours, &c.

KINCLAVEN.

MANIFOLD WRITERS.

Sir,—In answer to the inquiry of "Litera," in your 690th Number, I beg to suggest the following method of procuring several copies of a letter with expedition and secrecy:—

First write the letter with a pen on a sheet of paper (even as I am now doing), but instead of ink, employ the greasy or soapy substance well known to those who dabble in lithography, wetted with water, and which looks like a stick of Indian ink folded up in a thin sheet of lead. Then lay the letter fresh written on the face of a lithographic stone, and submit it to high-pressure for a short time; and the characters will be vividly transferred. (If the letter were held for a moment over steam to damp it, the better success of the transfer would be promoted.) Lastly, wet the stone, and print forthwith. All this might be accomplished by one person "*in secret*," in as little time as it has taken me to write this letter.

Yours obediently,

F. O. H. SIDMOUTHENSIS.

London, Nov. 1, 1836.

MODE OF PRESERVING THE GAS OF BALLOONS—CARBONIC ACID FOR BALLAST.

Sir,—It is gratifying to know that an active movement is, at last, being made for turning to some useful purpose a discovery which has for so long a period been a matter more of idle curiosity than otherwise. The papers on that subject which have from time to time appeared in your excellent Magazine, will form an interesting feature in the history of aeronautics, and it is hoped that these will be continued, notwithstanding the chapters of "improbabilities" which, on the whole, have not as yet put forth any plausible objection to the purpose.

Considering the great expense which attends the inflating of a balloon with coal-gas, owing to the unusual charge made by Gas Companies on such occasions, it would be desirable that some means were devised whereby the volume of gas might be turned to better account than heretofore. At present a large quantity is thrown away in order to cause the descent of the balloon, and the residue is as freely parted with when it has descended. Now, if two or more "ascents" could be made conveniently with the same volume of gas, and at the expense of *one* ascent, it is not unlikely that the so doing would be accounted an improvement. The following method is simple:—1st. Let a spherical, air-proof, silk bag be suspended from a hoop traversing the circumference of the balloon near the top, reach within a few feet from the neck, and be connected to the apparatus, afterwards described, by an air-proof tube passing through the neck of the balloon; this bag to be the receptacle for carbonic acid gas, to be generated when the machine is required to descend. 2d. Let a small cask, 12 or 14 inches wide, be fastened beneath the car; this cask to be equally divided by a cross partition, having an aperture in the centre provided with a leaden plug, fitting closely, and raised by a wire passing through the tap; each division to have an opening for introducing substances, and the lower one an additional orifice, into which is inserted the conducting tube to the silk bag. Such an apparatus would not be obstructive, nor its weight considerable; the cask, suitably decorated, might be fixed under the car, and the tube be placed along one of the cords suspending the car.

Now, supposing that a balloon has gained a high elevation, it is necessary, in order to cause its descent, that the ascending power be overcome. To attain this end by means of the apparatus above described, it is necessary while inflating the balloon that a space be left as allowance for the distension of the ballast-bag. Now, let the stopper in the cask be raised, instantly the dilute acid will act upon the chalk, and the dense gas discharged thereby will rush with rapidity along the tube and expand the bag; the latter, by its weight, will in a short time produce the desired effect; the supply from the cask may easily be regulated and checked when necessary

by twisting or tying the tube. Thus, the machine may be brought to the earth; and made to re-ascend by unfastening the tube, and projecting it below the car; the ballast will gradually fall out, or it may be driven out by compression. The process may be repeated.

I am, Sir,
Your most obedient servant,
ROBERT MUNNO.

ON THE FIRST EXCITEMENT AND GERMINATION OF PLANTS; WITH REMARKS ON THE FRANKLINEAN THEORY, AND THAT OF MR. MACKINTOSH.

Sir,—We have endeavoured to trace a relation between the structure and functions of plants, and the properties of the surrounding elements, favouring the conclusion that electricity is the grand agent by which the several processes of vegetation are carried forward. Air, water, and solar light, have respectively been viewed as conveying electric influence to the vegetable kingdom. The predominant influence of each of these elements appears to take place in the order just mentioned; and the dry winds of March, the copious rains of April, and bright sunshine of May, appear to exhibit this succession in a general view, while the mingled and varying states of the weather show the almost continual necessity of their mingled operation in different degrees. It may here be observed by the way, that whereas the vital principle in animals is maintained by means of a portion of the atmosphere which is uniformly supplied at all seasons, and is administered to all the more perfect kinds in the exact proportion which is requisite to preserve the uniformity of their heat and vitality; that of vegetables, depending on the vicissitudes of the seasons, and even on the variations of the weather, is subject to the like vicissitudes and variations. To me it appears, that in reality they both depend upon the same subtile fluid as emanating from the sun; but whereas, plants derive it in an uncombined state from the floating winds, the condensing vapours, and the direct rays of the sun; animals imbibe it by means of the peculiar organisation of the lungs in those more copious and uniform supplies which their more elevated nature requires, by a chemical decomposition of oxygen in those organs. But this important branch of inquiry cannot be pursued in this place. I now wish to offer a few remarks on the progress of vegetation under the influence of the several elements.

1st. The electric influence of the *air* in producing the first excitement and spring of vegetation, appears to depend much on the partial absence of its influences under the forms of condensing vapour, and of solar light; as these, by employing the electric fluid in the processes of growth and maturation, would direct large quantities of it from that which is all-essential in the first instance. Hence, our March commences with a total destitution of leaves in all the more foliagenous species of trees, while the annuals among herbs have disappeared. The only vegetative remains of these respective kinds are contained in the buds protruding from the trees, and the seeds which lie concealed in the soil. Thus a large proportion of those rays, which, as the season advances, are employed in the two subsequent processes of vegetation, are reserved to impart electricity to the air, as the instrument of producing the first excitement in the yet closed germs. As a farther preparation,—during the winter now at its termination, the vapours exhaled into the atmosphere in the preceding summer are gradually condensed, and conveyed into the earth in the forms of rain, snow, and hail, by which means that extraordinary dryness, which distinguishes the early spring, and is remarked by agriculturists for its salutary effects, is in part produced; and in part, probably, by the rarifying influence of the increasing rays, causing the lower strata of our climate to ascend and give place to the denser and yet drier air rushing in from regions into which fewer vapours had been exhaled, and from which they had been more completely removed by a more condensing temperature. These winds are, moreover, of use in removing all particles of moisture, together with other impurities from the exterior of plants, and from the surface of the soil; so that nothing may be left to be acted upon by the electric influence, but the buds, seeds, and emerging shoots. When the winds have sufficiently performed their office of desiccation, that of vegetative excitement and germination seems speedily to commence. The *glancing* rays of the early season of the year

are evidently more favourable to their accumulation in the atmosphere than the more direct rays of the advancing season; and from this cause, in conjunction with those above stated, a much larger proportion of them will be lodged in the air, or resting upon it, reaching to some distance upward, than at a later season. The electric matter accumulating in the higher strata will propel it downward, and probably at once force a portion of it into the earth, and cause a partial state of negation of it upon its surface; which being followed by a powerful rush upward, as the temperature and rarefaction of the contiguous air increases, must give a great impulse to the seeds and shoots, and act as the immediate cause of germination. As the first incitement to the seeds contained in the soil may thus be produced, so that of the buds of trees must be greatly promoted by the electricity of the rushing winds.

That *the electricity is much more intense during the cold, dry winds of March in a clear atmosphere than at any other season*, I have been assured by Mr. Sturgeon to be the result of his numerous experiments, in conformity with the few observations which I have made. It may be worth while, however, to observe, that the conclusion had presented itself from the above considerations previously to his favouring me with this information; so that theory and experiment have in this respect coincided, without the one being biassed by the other. That a *negative* state of the seed and the soil in which it is deposited, in respect to the atmosphere, is peculiarly favourable to germination, while it is much promoted by electricity in general, appears from the following experiment. I sowed some mustard-seed on the 20th April in similar soils, one electrified positively, a second negatively, and a third in its ordinary state. In four days the electrified plants appeared, but those negatively electrified were the most advanced; those not electrified did not appear till two days later. On the 12th May the plants, in a negative state, had grown to 2¾ inches; those in a positive state to 2¼ inches; those not electrified to 1⅛ inches; the electrified plants were strong and flourishing in proportion. The superiority of negative over positive electricity in the seeds, and of either in promoting their vegetation over seeds in the ordinary state, had been observed and supported by numerous experiments by Dr. Caxmoy and the Abbé d'Ormoy, many years since, though I had no expectation of such a result at the time of making the experiment, prior to my remarks on the relative electricity of the atmosphere and the soil. It is probable that any state of electricity, by propelling the fluids of vegetation, causes expansion and growth; while that which acts in an upward direction, like that of the atmosphere upon the soil, is most efficacious. Mr. Weekes confirms the general fact in its application to positive electricity, by observing, that his "electrified plants appeared several days before others," placed with a rigid regard to the sameness of circumstances, excepting the absence of electricity; and that "they continued afterwards to grow with a much greater degree of vigour." He has also produced similar results by means of the galvanic battery, with the particulars of which, as of many other experiments on vegetation, "especially with plants growing at various altitudes," which I have reason to conclude he has been pursuing with ardour during the last summer, I trust he will ere long favour the public.

I am here induced to recite the particulars which I received from a medical electrician, of which a general mention has been made. A narcissus plant which was in a very languishing state, being placed in the room in which his powerful electric machine was kept in frequent action, soon began to exhibit signs of extraordinary vigour. *It grew to the height of thirty-six inches*, and was stout and luxuriant in proportion. Some branches of the moss-rose and various other flowers placed in water on the mantle of his room, retained their colours while the seeds were forming, during about five weeks, and at last dropped off without assuming a withered appearance. A hawk's-cap lily drooped during several hours of the night when the action of the machine was suspended, but resumed its vigour, and again stood erect under its renewed action. These particulars, on the general correctness of which I have every reason to rely, are admirably illustrative of the principle, that a *relative* state of negation in the source of vegetation from beneath, as compared with the positive state of the atmosphere, though without any absolute addition to the

quantity of electric matter, is a most material requisite to its origin and progress. The general high temperature of the room no doubt aided considerably in the process. I lately observed that, whereas sprigs of plants inserted in water, from which the carbonic acid has been expelled by boiling, appear to perish nearly as rapidly as if they had been destitute of moisture, when the water is impregnated with an additional quantity of this gas they retain their vigour; which agrees with a similar experiment on the autumnal leaf above related, by which its drop, without withering on the branches, appears to been owing to the presence of carbonic acid in the water. It appears, therefore, highly probable that this gas is essential, or greatly conducive to the rise of the sap in consequence of the affinity of its oxygen with the positive electricity of the atmosphere, while its carbon is separated from it and deposited in the leaf, or conveyed into the substance of the plant. In consonance with this position, Mr. Weekes, in a letter of May 14th last, has the following interesting statement:—"As far as my experiments have yet gone, I am justified in saying that carbonic acid appears to be most abundant about the end of the spring months and the beginning of summer; it decreases gradually (leaving out of consideration contingencies from local causes), and, of course, its quantity is least in the ordinary atmosphere during the months of winter."

The electricity of the air, as distinguished from that of vapours and of solar light, has chiefly occupied the above remarks. My endeavour has been to show that the solar fluid is economised in it, to the exclusion, in a great degree, of the action of vapours and of the direct rays of light upon the shooting and expanding leaf, for the purpose of imparting the first excitement to the germ. The process of nutrition, in connexion with an increased supply of electric matter, as the principle of vitality now becomes indispensable, and is accordingly administered in abundance.

I must postpone the additional remarks which I wish to offer on the latter processes of vegetation to a subsequent occasion, should the further prosecution of the subject prove acceptable to your readers. It was my design to have completed my view of electro-vegetation in a less interrupted series; but besides that, other engagements have occupied much of my time—particularly in connexion with a Mechanics' Institution recently formed in this town, and I have the pleasure to say, with a success in point of numbers, unanimity, and activity, and under the auspices of a reformed corporation, which affords every indication of extensive usefulness—I find so many difficulties to encounter, with some new lights occasionally breaking in upon the wide field into which I have adventured with my able coadjutor, that I am often obliged to suspend farther remarks for more mature and satisfactory information. I owe to several of your correspondents my respectful acknowledgments for the very favourable notice which they have taken of my letters; particularly a gentleman under the signature of W. B. in your Number of May 14th last, in connexion with his remarks upon the theory of Mr. Mackintosh, and, I think also, Mr. Mackintosh himself in a recent Number. As the statement of his theory contained in your No. 645, December 19th last, is now before me, I cannot abstain from offering a remark or two with relation to it; but it must be chiefly to notice the ground-work upon which it proceeds. I allude principally to his account of the Franklinean theory, which in several particulars is incorrect, as stated by Franklin himself, and as may be easily proved by a few of his plainest and most decisive experiments. But, notwithstanding the inaccuracy, particularly of the assertion that non-conductors contain very small portions of electricity, or, as I prefer terming it, *electric fluid*, I am not aware that Mr. Mackintosh's theory is materially influenced by it, which, from the cursory attention I have hitherto given it, promises, I should think, to throw considerable light on the future researches of philosophy. In short, the observation of your correspondent, *Vivat Major*, that "it is drawn up with much ingenuity; that there is an air of probability, and in some parts even of plausibility, about it, which renders it eminently worthy of investigation by the scientific world," is in unison with my own convictions; at the same time that I cannot help strongly concurring in what the same writer adds with respect to the wise authorship and superintendence of

the Ruler of the Universe. Indeed, as human experience has uniformly witnessed nothing but the most complete control over the powers of nature, so that what would otherwise prove most destructive, is so overruled and regulated by counteracting causes, as to produce the most harmonious and beneficial effects, its analogies furnish strong grounds on which to repose our reliance for the future; and that any tendencies to evil which may hereafter lead to its actual production, will in due time meet, in like manner, with counteracting causes productive of the like salutary issues. If discoveries in astronomy, geology, &c. have shown that disorders have occasionally occurred; that our globe has been converted into a chaos, and that other globes or systems have disappeared from the universe;—the actual state of things abundantly manifests something more than that these disorders have not been suffered to continue; the present state of our globe, with its principal inhabitant, of an order greatly superior to any of which traces remain in its former states, evinces that the evil has given occasion to a predominance of good, while the general harmony of the mundane universe shows that no even apparent evils have been suffered to have a permanent continuance.

In your Magazine, No. 630, p. 101, &c. I have alleged some facts in proof of the position that there is one uniform fluid issuing from the sun as its principal source and centre, which, under different circumstances, produces the several phenomena to which the terms *light*, *heat*, or *caloric*, and *electricity*, are applied. It is to me perfectly evident, that the stream of light which may be seen issuing from the mercury of a thermometer into the vacuum above, on applying positive electricity to the ball, is a *real* fluid. This fluid, instead of being contained in small quantities which are capable of being extracted from them by friction, as Mr. Mackintosh states to be a part of the Franklinean theory, was proved by the Doctor, as he himself says, to be "contained in glass in great quantity;" and also that it adheres to this substance with so much tenacity that no portion could be conveyed to one side of a piece without expelling an equal quantity from the opposite side. This he explains with his usual perspicuity as follows:—"Suppose the common quantity of electricity on each side of the Leyden bottle before the operation begins, is equal to 20; and at every stroke of the tube, suppose a quantity equal to 1 thrown in; after the first stroke the quantity contained in the inside will be equal to 21; on the outside 19. After the second, the inside will be 22, the outside 18, and so on, till after 20 strokes, the inside will have a quantity of electrical fire equal to 40, the outside none; and then the operation ends; for no more can be thrown into the inside when no more can be driven from the outside. If you attempt to throw more in, it is spewed* back through the wire, or flies out in loud cracks through the sides of the bottle." The correctness of this statement is shown by insulating the jar; in which state the charge proceeds only as sparks are drawn from the outside; and when it is charged, by passing the fluid from the inside to the outside, through an insulated discharging-rod, by which means the communication between the sides being made by conductors, the quantity, say 20, which had been accumulated within, and taken from, without being restored to the latter, an equilibrium is effected, and all signs of electricity disappear. Again, the jar can be charged from itself, by insulating the cushion of the machine, and passing a chain from the outside of the jar (also in a state of insulation from the ground, and suspended by its knob, or ring communicating with the inside, from the prime-conductor,) to the cushion. In this state, on turning the machine, the fluid is drawn from the outside by the rubber, and passes through the prime-conductor to the inside, and thus the charge proceeds with peculiar facility. That the fluid when charged is actually in a state of accumulation on one side, and as destitute of its ordinary quantity on the other, is made manifest to the eye, by passing the charge, while the jar remains insulated, through an insulated discharging-rod, the ball in connexion with the outside being removed, and the wire held at the distance of about an inch. In these circumstances the fluid will be seen to rush like a stream from a fountain, from the wire to the external coating;

* I have chosen to retain this rather indecorous term, as peculiarly expressive of the manner in which the fluid is seen to rush from an overcharged jar, plainly showing that it *is* overcharged, and is throwing off its superabundance.

whereas, if the same end of the rod be reversed, the ball touching the outside coating, and the end of the wire held at an inch distance from the knob of the jar, a very different appearance will be seen; not a rush from, but a globule of light, indicating that the fluid is taking an opposite course. *This* non-conductor then contains within its substance a sufficient quantity of electric fluid to produce its charge and shock; and the fluid adheres to it with so much tenacity, as to be incapable of being absolutely withdrawn from it;—all that can be effected, is to alter its distribution upon its respective surfaces. When this is done, the one surface is in a *positive* or *plus* state of electricity, having more than its natural quantity of the fluid accumulated upon it; the other is in a *minus* or *negative* state, being in a like degree deficient;—upon the communication being made between the surfaces by the discharging-rod, the fluid resumes its just distribution through the glass, and all signs of *electricity* disappear. For, the phenomena to which this term properly applies, are to be distinguished from the fluid itself; which, when distributed in equable proportions, according to the capacities of the respective bodies for receiving it, produces no electrical effects; or none to which that term is ordinarily applied; as it simply denotes the consequences resulting from the distribution of the fluid in disproportionate quantities, within or among different bodies.

That light bodies, under the influence of the same electricity, whether positive or negative, should separate from each other, and be attracted by surrounding bodies may, it seems to me, be much more easily explained by the general principle of the effort of the fluid to recover its equilibrium when disturbed, than by so violent an hypothesis as that of two electric fluids. Such substances will in both cases be drawn from their common situation toward the contiguous bodies by the opposite state of electricity which prevails around, and which will be increased by the approach of the light bodies. If a conducting substance in an opposite state is brought near two electrified balls, they will both fly in the same direction towards it, and the fluid will become equally distributed between them; but if they are surrounded by nothing but air to a considerable distance, they will verge to an equal extent from a perpendicular to the point from which the threads are suspended in opposite directions; this being the state to which they will be determined by the general effort of the fluid to recover its equilibrium.

A fluid which is proved to exist in such considerable but uniform quantities in glass, and to adhere to its substance with so much tenacity, exists, it is probable, in similar circumstances in other non-conductors; and in its quiescent state, may be identified with caloric, regarded as the great principle of expansion in all gravitating matter. But having occupied a larger space than I anticipated in endeavouring to clear a subject of great importance, both in connexion with the theory of Mr. Mackintosh and in the illustration of the principle and several processes of vegetation, I must close this letter.

Yours, &c.

T. PINE.

Maidstone, Oct. 19, 1836.

MR. ROWLAND HILL'S ROTARY PRINTING-APPARATUS.

Sir,—It is only a few days since my attention was first called to a letter from Dr. M'Cormac, of Belfast, inserted in No. 682 of your Journal, in which, with reference to a notice of my rotary printing-machine which appeared in No. 675, he describes "a rude machine" which he constructed about five years ago, and which he appears to consider the same in principle with my own, and, consequently, as giving him a prior claim to whatever merit may be due to the inventor of rotary-printing.

I am not at all inclined to contend with Dr. M'Cormac for the merit of having *first suggested* rotary-printing, for this very good reason, that the merit clearly belongs to neither of us, but to a highly ingenious and useful man, the late Mr. William Nicholson, who, as early as the year 1790, took out a patent for a printing-machine of a construction which differs in no important particular from Dr. M'Cormac's.*

The advantages to be derived from

* Vide the 5th vol. of the *Repertory*, first series, which contains the specification and plates of Nicholson's machine. Mr. Nicholson's merit is the greater, inasmuch as his suggestion was long anterior to the construction of the first printing-machine by Koenig.

making the form of type cylindrical, and giving it a continuous rotary motion, and thus rendering the process of letter-press printing similar to that of calico-printing, are so obvious (especially since the invention of the paper-machine has enabled paper-makers to produce a sheet of indefinite length), that in all probability such an arrangement has been attempted by many. In order to *accomplish* this object, however, several serious difficulties must be overcome, the most obvious of which is that of firmly attaching a large form of type to a cylindrical surface; a difficulty which, as far as I know, has never been overcome except in the case of my own machine. The means of attachment described in Mr. Nicholson's specification are clearly insufficient; and it is well known that Mr. Nicholson never succeeded in constructing a working machine. The means employed by Dr. M'Cormac do not differ essentially from those proposed by Mr. Nicholson; and however successful they may have been in holding together the small quantity of type with which Dr. M'Cormac appears to have made his experiments, a little consideration will show that for the purpose of securing a large mass of type, as the heavy columns of a newspaper for instance, they are altogether inadequate.

For retaining the separate types in their places, both Mr. Nicholson and Dr. M'Cormac appear to have depended entirely on pressure given to the whole mass by means of screws, that is to say, their means were similar to those used in ordinary printing; but in a form of the ordinary type, pressure is applied (generally by wedges, but occasionally by screws,) in two directions; in one direction, forcing the types of the same line against each other; in the other direction, forcing the types of one line against those of the contiguous lines; while in a cylindrical form, it is manifest that forcible pressure can be applied in one direction only, viz. in a direction parallel with the axis of the cylinder. Any force applied in the other direction must tend to raise the type from the cylindrical surface, and would therefore be mischievous. It follows then that the security derived from pressure would be much less in a cylindrical form than in the ordinary flat form; while it is obvious that the security required is much greater, for who would think it safe to fasten a large flat form on the circumference of a wheel, and then to whirl it round? Or if by any improved means of pressure such an arrangement could be rendered safe and practicable, would it continue so if all the screws or wedges which act in one direction were loosened?

The necessity for some additional means of securing the type appeared to me to be so obvious, that until they occurred to me, I considered it useless to try any experiments.

It would occupy too much of your valuable Journal to attempt a description of the means which, after a few modifications suggested by a series of careful experiments, were ultimately adopted for securing the types in my machine. Nor is it necessary, as my specification (with plates, has recently been published at full length in the *Repertory*.* I would remark, however, that in the opinion of many eminent printers who have seen my machine, the end in view has been fully accomplished; for while any portion of type may be detached from the cylinder with a facility even greater than that with which a similar change can be made in an ordinary form, each letter can be so firmly *locked* in its place, that there is no danger whatever of its being loosened by centrifugal force or by any other cause.

The inking-apparatus presents another great difficulty in the construction of a rotary printing-machine. In the ordinary machine the supply of ink to the type is only occasional; the ink being spread out on the inking-table, and the rollers charged in the intervals; but in the rotary-machine, the type requires a constant supply of ink; all the processes must therefore be carried on simultaneously. Dr. M'Cormac does not appear to have made any attempt to construct a proper inking-apparatus. He states that he applied the ink by means of a single roller.

There were other difficulties to be overcome, and some of them very serious ones; as that of uniformly wetting a long scroll; that of cutting the damp paper into sheets as it passes through the machine, and *cutting it in the right place*, that is, in

* Vide Nos. 33 and 34 of the present series.—In my specification, Nicholson's machine and Cowper's bent stereotype machine (the one which Dr. M'Cormac saw at Clowes's,) are expressly mentioned.

the middle of the space between impression and impression. But without entering on a consideration of these, and without even naming numerous other difficulties, I trust enough has been said to show that in this invention, as in many others, the suggestion of the general principle on which the mechanist is to proceed, is only a step, and by no means the most difficult step, towards the final attainment of the object. To the merit of having been the first or even the second to *suggest the principle* of rotatory printing, I make no claim; but I do claim for myself and my brother, Mr. Edwin Hill, (who has all along been associated with me in this undertaking, and without whose aid it would probably never have been brought to a successful issue,) whatever merit may be due to those who by expensive and laborious experiment extend, realise, and render practicable and useful that which was previously a mere crude conception; and, although it is very unimportant, I may perhaps be allowed to state, that it was not till after my brother and I had completed an actual working machine, that we had any reason to suspect that rotatory printing had ever before been attempted.

Your most obedient servant,
ROWLAND HILL.

2, Burton-crescent, London,
Oct. 30, 1836.

OUTLINES OF A NEW GALVANO-ELECTRIC THEORY OF THE UNIVERSE. BY COL. MACERONI.

(Continued from p. 44).

The motion of the tides is rendered more ot less irregular by the obstructions of the great continents of Indostan, Africa, and America, to the regular correspondence of the rise of the waters, so that its apex shall always form a line from the centre of the earth to that of the moon. These effects are so easy to conceive, that it is unnecessary to swell this paper by dwelling on them. One thing I would wish to be remarked, which is, that were it possible to construct a vast coffer-dam in the middle of the ocean, so as to form a kind of *pond*, isolated from the rest of the waters, it is certain that the water so confined would remain always at one level—neither rising nor falling; because it could not be acted upon by the Polar waters, which rush in rotation to supply the elongation or progressing ellipsis, above spoken of; and which is formed partly by the successive deprivation of the stellar pressure on a portion of the waters, and partly by the lateral action of the similarly caused elongation of the atmospheric, elastic envelope of the globe.

All bodies in a state of what we call *solidity* are very far from being in that condition indicated by the grammatical value of the term. The constant passage of the stellar rays and of the expansive emanations of the earth, cause all bodies to be so completely riddled with pores and passages, as to make them analogous to the pumice-stone and sponge, the porous structure of which are only *more visible to our senses* than that of a piece of iron or hard stone. How far the particles of even the hardest substances are really in contact with each other, it is difficult to say; but it appears certain, that in all such bodies the quantity or sum of space, motion, and intestine activity, is far greater than that of really solid matter. When a solid body, a metal for instance, is submitted to the action of fire, the globes of caloric penetrate into its cavities—subdivide themselves in every direction—agitate and dislocate the filamentous connexions of the body—cause it to expand—overcome by degrees the compressive stellar power, until the point of equilibrium between that pressure and the internal expansive agitation of the metal arrives. At that point *fluidity* takes place; but a further increase of expansive action produces a total separation of the parts of the solid, and, at length, it is evaporated and dispersed in the shape of its original molecules.

By comparing the properties and phenomena of all gases, we must be induced to believe, as I have above predicated of hydrogen and oxygen, that they are bubbles or bladders composed of a fluid, enclosing a globe of magnetic, galvanic, or electric matter. Their compressibility is the consequence of such a conformation. On the other hand, if we regard the atomic particles of water as solid globes, of an infinitely smaller size than the more compound globes of gas, we shall find that such a definition satisfactorily tallies with the properties of fluids, such as their (comparative) incompressibility; their pressure (especially the *lateral*,) when confined in a recipient;

their propulsion and ejection through tubes; their admixture with the atmospheric air, and their *quasi*—gasification by conversion into steam. The latter phenomenon is very analogous to the conversion of water into the hydrogen and oxygen gases, inasmuch as the conversion of water into steam consists in the globules of caloric, *being each individually enveloped in a case or capsule of water*, forming together elastic vesicles; which vesicles, in proportion to the activity,—that is, the quantity of the caloric globules introduced into it by the action of what we call fire, are endowed with a progressing degree of activity and expansive power in proportion to their subdivision and tenuity. Hence, steam becomes a gas by being composed of hollow globes, containing each a central expansive globe of caloric, or electric matter, analogous to the capsules of water which envelope the major and the minor fluids of the galvanic or electromotive pile, we call galvanic. The extreme tenuity of the globules of water enables them to mix most intimately with the atmospheric air, and, in fact, with all other substances, so as to become almost identical with their composition, without their presence being detected by our senses. A sudden change in the temperature or quantum of caloric, resolves a number of vesicles into one, and through the increased size, renders them visible to our optics. At length, by the process of running one into the other, a drop of water is formed, which falls either in the shape of mist, or dew, or rain. The external application of cold to the mass of expansive hollow globules, occasions the diminution of the expansive action of a multitude of globes, which concur to compress and preserve the identity of the others, or rather, of each other. The result is, that the expansive action of each globe predominates, and bursts the containing envelope, precisely as would occur, if any number of the globes which compose our universe, had which mutually compress each other, were to be withdrawn or annihilated. And endless succession of annihilations must follow the successive predominance of the expansive force, through the abstraction of the radiating compressive ones. This reflection brings us back again to the sublime necessity of an infinite and boundless number of glorious globes, without limit or circumference, *each is the centre of the infinity!* Without such an arrangement, all the suns and stars and planets which our best telescopes can bring within our view, and as many more as would amount to the number of all the grains of sand that it would take to form the masses of all these billions of quintillions of globes, each a million times bigger than our earth, would be but as a grain of dust, a point, an atom, in comparison to THE WHOLE! And all those globes, which could not be counted by covering the surface of our earth with the most condensed expressions of numbers, would, in an instant of time, be dissipated, and their particles be dispersed through infinite space by the effect of expansion, unrestrained by the universally surrounding expansive actions of *the whole!* A drop of water cast into the burning crater of Mount Ætna could not be more effectively divided and dispersed, than would be all the stars and globes that all the men who ever lived could express by numbers in a million of years on the surface of a million of worlds, if any limits were suddenly to be assigned to the existence of *other* globes surrounding them *ad infinitum!* Oh! great and glorious spectacle! oh! TRUTH, at once incomprehensible, and *impossible to be doubted!* Well may MAN look upon himself with just and well-earned pride, and deem his species to be the last and most perfect fruit of this globe's state of virility and perfection! *Man*, although but a crawling, parasitical, cutaneous insect of the globe which he inhabits, at last will scan the laws of his own ephemeral life, as well as of the existence of his paternal globe, and of the millions of millions of others that surround it! The index and proof of the arrival of this *our* globe at a state of virile perfection will be, the arrival of the best fruit of its production to a state of knowledge, happiness, and peace, to which it is evidently now fast approaching. When there shall be no more wars; when mankind shall clearly see the truth, that the prosperity and happiness of every community, and of every individual, is furthered in proportion to the happiness and prosperity of surrounding ones; when they shall feel that individuals and communities are dependant

for the beneficial influences of surrounding good by promoting the general weal of all mankind—then kingcraft, priestcraft, wars, violence, persecutions, and all false views of self-interest, will vanish. The true political, or rather social economy, will be established in axioms of irrefragable *truth*—and the human species will have attained the utmost degree of knowledge and of happiness of which its nature is susceptible. This "consummation so devoutly to be wished" is coming on much faster than the *generality* of benevolent observers may suppose, or dare to hope for. Knowledge and improvements are now evidently progressing in a geometrical ratio. We are gathering the knowledge of the past at a rate far more rapid than "compound interest." Each succeeding year of knowledge is as the *cube* of the preceding one. At last, the fetters to the free expression of man's thoughts, imposed by interested, idle, fraudulent legislators, will give way. The real interest of communities will prevail, and honest legislators will make good laws, on which the existence and happiness of mankind depend.

The extinction of the last volcano on the surface of this globe, will be the sign of its youthful effervescence and productive energies being on the wane. We cannot call this globe or the other globes, or stars, exactly *organised* identities, because they want that regular and permanent establishment or system of vessels and mechanical viscera, which belong to such as we call organised beings. But our and other globes are identities of the primary or most simple order, possessing many attributes in common with those called organised. Their motion is at no time voluntary; they possess nothing like nerves—no *sensorium*—no, properly so called, irritability. But the *parts* of which all globes, animals, and vegetables are composed, are globes endowed with the most simple attributes of vitality. Internal expansion, transpiration, external compression, and vibration. All globes, animals, or vegetables, must have their origin in a gaseous or fluid state. A fluid medium, tranquillity, caloric, and magnetic combination or *duality*, are necessary for the development of animals and vegetables, as I shall attempt to show.

F. MACERONI.

MR. DICKSON AND THE CORNISH ENGINEERS—REJOINDER.

Sir,—In your 688th Number, I have seen another letter from Mr. Enys, who says that the object of his former letter is attained by my expression, of his being the "champion of the Cornish engineers;" and also by my corrected statement of his former assertions. I certainly have no objections to his assuming that character, but I repeat, that all my observations on this subject are of a general nature; and as to my corrected re-statement of his assertions, I am not aware of any such thing. I never misrepresented any assertion of his, consequently there was nothing to correct. A quibble was certainly started about the past and present time of the verb, *to be*; and I freely gave my opponents the benefit of both, as well as the future. But let them not, on that account, consider themselves liberated from proving their assertions—(about doing so much with a bushel of coal), and that in the way which I have delineated; for to the then future I must now affix a reasonable limit, and that is one year, and not exceeding two. And now with all the modes, tenses, and degrees, &c. in their favour, if they do not proceed and endeavour to prove what they have said, the "strongest reprobation or tempest that they had in store for" the engineers of other parts of the kingdom, whose "opinions or assertions they regard with the utmost apathy or disdain," will recoil upon themselves with an increased severity.

As Mr. Enys has become the "champion of the Cornish engineers," I fear that I shall unexpectedly be taken (or mistaken) to be the champion of "the engineers of the other parts of the kingdom;" but I am not without the consolation of a firm belief, that I shall meet with the support of the intelligent class of men last alluded to, if I stand in need of it. Even alone, however, I do not shrink from the task which circumstances have accidentally imposed upon me.

I am glad that Mr. Enys now says, that either the weight moved, the height or distance, or the quantity of coal used, may be made the varying quantity. This is nearly what I want them to do; consequently, they must abandon the [illegible]

(which cannot be varied), otherwise their practice is not worth the name. In another part of his letter (alluding to the practical proof required) the writer seems to say, that if my objections bore any other name than a protest it would be more agreeable, and that I ought to have examined some of the mines, &c. This certainly is going from the question. Suppose I had said, "I do not believe, or I deny such an increase of duty"—this would not have altered the case, and why require me to show, particularly by calculation, how the errors have found their way into the stated amount of duty, when the Cornish engineers, or their calculators, are the most fit to give that information? Again, the writer says, perhaps some one of the large mines (meaning the proprietors, I presume,) might undertake the necessary trouble and expense for the satisfaction of known parties of eminence, but certainly not to satisfy idle curiosity. All this is scarcely worth notice, and Mr. Enys, of Enys, ought not to have said so; but it will be quite time enough to accuse me of idle curiosity when I take a trip to Cornwall for nothing, as he has hinted; and had he mentioned the degrees of eminence or qualification suitable to their views, I could have answered him in various ways. I certainly cannot go farther back in your columns than September, 1832, No. 473, which will be sufficient for this case, and show that I am not of yesterday, and that certain gentlemen deeply interested in Cornwall did not hesitate to profit, and still do, from the result of my professional exertions. I allude to the copper-smelting affair at Swansea, and other places. I still hope there are some honourable men amongst them, and that I shall experience the fruits.

I must now conclude with a few words to Mr. Enys. I would advise him, 1st, to abandon all contention; 2dly, use his influence to get this affair practically settled in the way that I have described; and 3dly, when that is done, that the water is all taken from one level; and "to prove as far as practicable the coincidence (or difference) of theory and Cornish practice," so that the tables may not be turned upon him, and that the Cornish engineers may be freed even from suspicion. If they cannot do so much with a bushel of coal as they have said, I am sure the public will appreciate their endeavours, such as they are, and I shall be one of the first to acknowledge their unparalleled exertions and perseverance in this most useful and scientific pursuit.

I am, Sir, yours respectfully,
JONATHAN DICKSON, Engineer.
9, Charlotte-street, Blackfriars-road,
Nov. 2, 1836.

MR. MACKINTOSH'S CONCLUDING LECTURE ON THE ELECTRICAL THEORY OF THE UNIVERSE.

In this lecture (delivered on the 7th inst.) Mr. Mackintosh remarked, that if the earth be gradually approaching the sun, it was natural to conclude that the length of the year was becoming less in a relative proportion. Accordingly, we find that the Chinese, Indians, Chaldeans, Egyptians, Greeks, and Romans, however they differed on other points, all agreed in giving to the year a value greater than that which was known to be the true value at the present day. Now, the great object of the ancient astronomers being the calculation of eclipses, unless they had a knowledge of the true time, how could they have predicted the recurrence of an eclipse with any certainty? But the Sothiac period of the Egyptians put the matter beyond dispute. The Egyptians had more than one calendar, in one of which the year consisted of 365 days; they had no leap-years, but the supernumerary hours and minutes were allowed to accumulate until they formed a whole year, which was added to the amount, and this they called a Sothiac period, which originally consisted of 1,461 years—at the present day it would require 1,506 years to complete a Sothiac period; the difference being 45 years. And were we to suppose that the Egyptians (the most eminent astronomers that the world ever produced) could not bring their Sothiac period nearer than within 45 years of the true time!—we could not come to this conclusion,—and yet with this very imperfect time these astronomers could calculate and predict eclipses! To suppose so was an absurdity; it was impossible to calculate an eclipse unless the true time were known.

It was also found, that the apparent diameter of the sun was greater at the present day than it was found to be by the ancient Greek astronomers; and this also agreed with the assumption of the earth's approach to the centre. We were too apt to consider that these differences arose from the imperfect modes of observation pursued by the ancients, without considering that it was not only possible, but natural, that there should be an actual difference; seeing there is nothing stationary in nature, and that both the

ancient and modern observations might be correct.

In conclusion, Mr. M. remarked, whether this theory were founded on truth or otherwise, by inquiring into its merits our knowledge of the physical world would be extended and improved. So long as our inquiries were conducted with a proper spirit, and confined to subjects within the reach of the human understanding, the improvement of that understanding must be the result of those inquiries: there were some things beyond the reach of that understanding, and concerning those things it was neither needful nor proper that we should inquire. That, space was infinite in extent—that time was infinite in duration—and that the Divine Mind, being infinite in its attributes, presided over all matter and motion throughout this infinitely extended space and time—were propositions in themselves so plain, that they might be regarded as axioms. But they were, at the same time, propositions upon which we could not reason, because the limited capacity of the human mind could not comprehend infinite quantities. Nor was it proper that we should attempt to investigate the attributes or essence of the Divine Nature. The *modus operandi*, or manner of connexion between the external world and the volitions of the Deity, being beyond our comprehension and above our control, such investigation could lead to no useful result. But we might and ought to reason and inquire concerning the physical agents employed by Him in operating the various processes of the material creation which surrounded us, and of which we formed a part. This inquiry had a useful object, because it would lead us to useful and valuable knowledge. All the changes in the modes and qualities, or forms and attributes, of matter, were the results of motion—without motion there could be no change. If, therefore, men did truly and fully know the laws which regulated the motions of matter, it was evident their power over matter could be extended. On these considerations was founded the claim to inquire freely concerning the laws of *matter* and *motion*.

ACOUSTICS.

Many opinions of the probability of conveying intelligible sounds to great distances have been at different times entertained. Mr. Dick, of Glasgow, in his "Christian Philosopher," thinks it highly probable, that by means of acoustic tunnels, a clergyman sitting in his own room in Edinburgh might address a congregation in Musselburgh, or Dalkeith, or even in Glasgow. And Mr. Curtis, to whom the public are indebted for the invention of many valuable and ingenious acoustic instruments, while speaking in his new work on the physiology and diseases of the ear, of his acoustic chair, a model of which is in the Adelaide-street Gallery, states, that intelligence might be conveyed by it from St. James's to the Houses of Lords and Commons, and from London to the Castle at Windsor. On the same principle, a song sung at the Italian Opera House might be heard at all the other theatres in London. In these days of universal improvement, might not these suggestions be turned to good account?

NOTES AND NOTICES.

Sir,—In page 62 of the 690th Number of your Magazine, "Litera" expresses a wish to be put in possession of a small machine by which he may be able to take several copies of a letter on letter-paper. If "Litera" will apply by private letter to H. Truman, St. Owen-street, Hereford, he will learn of a small machine which will enable him to take off, expeditiously, as many copies as he may want, and without the assistance of either clerk or printer.—F. P. [Will F. P. favour us with a description of the machine in question? Any person whom he may depute will, on calling at our office, receive the balance of the sum transmitted in F. P.'s letter, after deducting the postage.]

Errata in Mr. Cheverton's article in our last Number:—

P. 90, col. 2 line 7 from bottom, for "that" read "than," and dele ",".

— 91, col. 1, line 9 from bottom, insert a period after "materialism," and next line, for "not" read "Not."

————, line 6 from bottom, for "upholders" read "upholder."

— 92, col. 2, line 6 from bottom, for "intellectual" read "intelligent."

— 93, col. 1, lines 25 and 26, for "quantative." read "quantitative."

————, line 29, after "solidity" insert "and other supposed qualities of matter."

————, line 37, for "vision, therefore," read "vision thereof."

————, line 42, after "forces," insert "with."

————, line 43, for "rude" read "made."

— 94, col. 2, line 45, for "flatter" read "flattered."

The publication of the Supplement to Vol. XXV. is unavoidably postponed until the 1st of December.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

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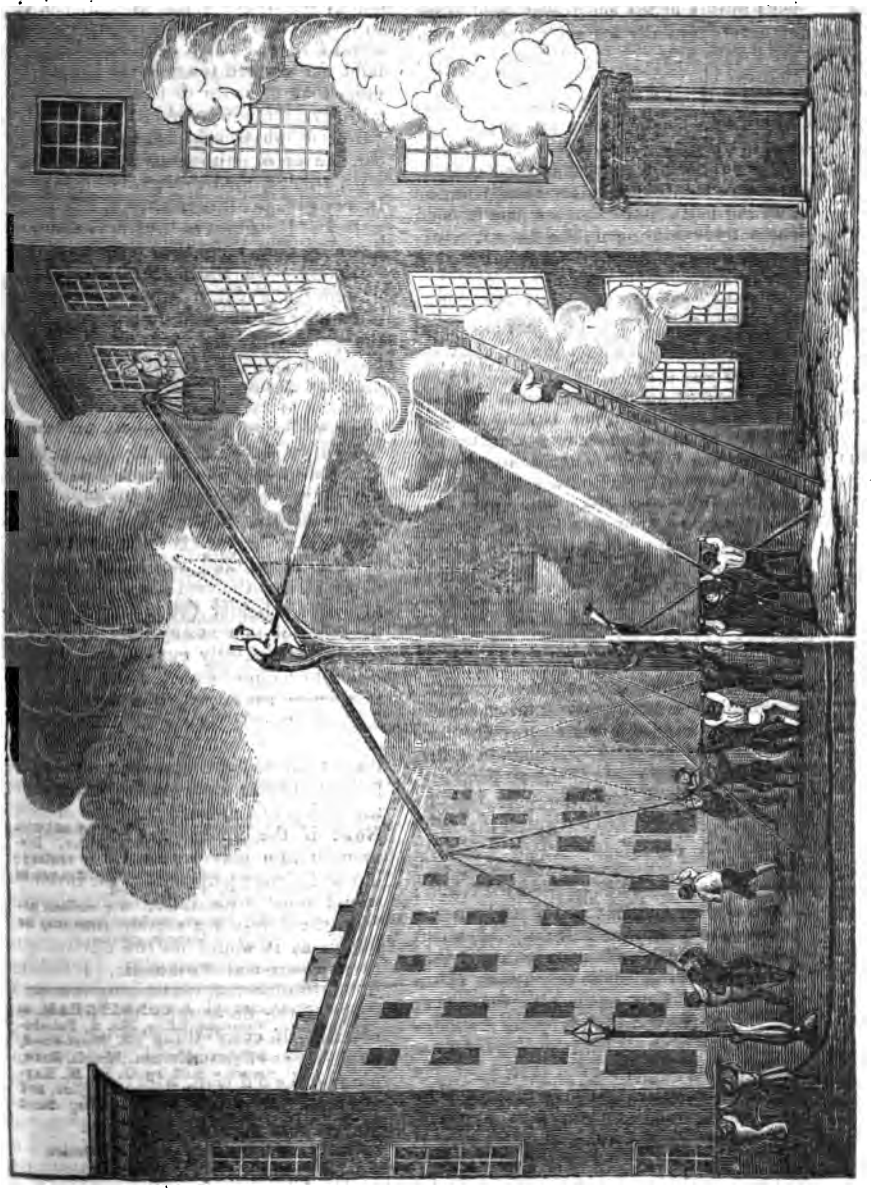

CAPTAIN SMITH'S FIRE-EXTINGUISHING APPARATUS AND FIRE-ESCAPE.

CAPTAIN SMITH'S FIRE-EXTINGUISHING APPARATUS AND FIRE-ESCAPE.

Sir,—The object of the following plan is twofold—to produce a much more powerful effect from fire-engines, and to introduce a fire-escape. These are subjects worthy of the consideration of every man, for it is daily too evident, even with the means at command in the metropolis, that the chances of arresting a fire which bursts out with fury is a forlorn hope. The water, which is generally negligently and scantily supplied, is fritted away by a variety of engines; rarely any one of them throws a volume of water actually on the burning matter, the greater part falls on the outside walls or on the flames, rivalling the wetted rod that feeds a fire at a forge.

To expect to introduce a fire-escape is also a forlorn hope, people in general having come to the conclusion, that before any one could have transported such a thing from a parish-church or engine-house, the unfortunate victims at fires suffered by suffocation, or were burnt to death. The fact is, "what is every body's business is nobody's." It would, therefore, be in vain to recommend for adoption any thing, howsoever simple, that persons had to bring to a fire to act exclusively as a fire-escape. But it is confidently hoped that the annexed diagram, when described, will convince the most sceptical, that such a desideratum may be brought into action with success in aid of suffering humanity.

The drawing represents a fire-escape in operation, and the most powerful fire-engine with its hose directed on a fire, from the top of a pole about 40 feet long, raised in its centre; the pole can be raised or lowered when required, like the mast of a barge,* round it is a sliding iron collar, having three oaken legs, with a stop-joint, the ends pointed with iron; these are opened out and placed on the ground, to steady the pole; a yard, about 40 feet long, the end cased with very thin sheet-iron, is hoisted up by a chain through an iron pulley; to the upper half of the yard, which is rather the longest, a hose is attached, reaching from the extreme end or yard-arm, then down the pole to the engine; this is always to be kept ready fitted to the yard (this hose, as seen in the drawing, is not used whilst the yard is employed as a fire-escape). The yard is balanced so that the lower or shortest end would move upward, if not held down by men with ropes; thus slung, it forms an universal joint; the upper end can be pointed perpendicularly about 60 feet (which is higher than any ladder), lowered towards the ground, or moved at pleasure to the right or left, with great facility. At the end of the yard is a light iron frame, called a basket, capable of containing two or three persons, attached to a chain rove through an iron pulley, and running along to a second pulley at the slings of the yard, and then down by the pole to the engine.

Action.—On the engine reaching its destination under a clever director, he must take up his position correctly, raise the pole, cross the yard, and while the hoses are preparing to act as if it were an ordinary engine. Should any person be observed to have his retreat cut off, and present himself at a window for escape, the yard-arm, with the basket, is to be directed to him by the men holding the ropes attached to the lower end. When he is safe in, if there are any flames under him, the yard is *to be turned round* by the ropes, and the basket lowered down. Here the yard has a *great advantage* over a ladder (and it can perform the office of one at any length), as persons are frequently cut off in their descents by flames below. If no one is seen to require assistance, but it should be supposed that there are *helpless children* or persons in such a state as to prevent them from saving themselves, a parent or fireman may, in some cases venture up in the basket and proceed in search of them. Now, if the fire-engine could not be brought into play whilst these acts of humanity were performing, the invention would meet with little encouragement from the Fire-office establishments, and justly, as it would not be advisable to leave a powerful engine idle. It is therefore to be observed, that during the operations of the fire-escape the fire-engine can act, if every thing is properly organised, as effectually as a first-rate engine on the old plan, with the advantage of playing on a fire from the top of the pole, if circumstances require it. But as soon as every effort has been used to rescue persons requiring assistance, the

* The pole may be in two pieces, like a mast and topmast; the mast might be always kept upright: if iron; the topmast could slide inside of it.

hose connected to the yard is to be brought into play* (which is the mainstay of the invention), and the water forced where *most serviceable* in a *powerful body*, guided by the ropes used to the fire-escape; this may be expected to produce an effect seldom witnessed, and prove that the introduction of the pole and yard, without reference to their uses as a fire-escape, would be highly beneficial; indeed, the hose of a second engine may be brought to play from the top of the pole. The highest stories of houses and stores may be reached by their assistance, and the roofs of others effectually wetted, to preserve them from catching fire. Valuable property, as pictures, &c. may be removed safely by this invention.

When the heat of the fire would admit of it (on its breaking out, for instance), a fireman might be placed in the basket and by means of a short flexible mouth-piece, screwed to the hose, direct the water more immediately on the place on fire. These are little refinements that may be found practicable, but it is presumed that sufficient has been shown to prove, that human beings may be saved who otherwise would be left to perish; and that a powerful stream of water may be directed on the object on fire, whether it be at the end of a room or a passage, instead of being scattered to the wind, reaching little more than the outside of the building, whilst the destroyer is within.

Finally, walls and floors may be examined after a fire from the yard-arm, at a time that it would be dangerous to place a ladder against them.

The humble inventor who urges the adoption of this plan until something better can be found, takes the liberty to remind reflecting persons, that it is not a single life, this or that house—but families, streets, and towns, that are often nearly swept away by fire under the present inefficient system; yesterday it was so at New York and in London, to-day at Quebec! It is, therefore, high time to be prepared to face the enemy with improved means of defence, and no longer be content with those which, judging from their effects, may be likened in many cases to the well-known plan for raising water adopted by an old woman.

As in cases of fire there are generally too many persons anxious to command, especially amateurs, with more zeal than judgment, it would be beneficial if a director were appointed to act, by consent of the whole of the fire-establishments of a city or town; the director to be the leading man of the first engine that reached the fire, who might be awarded a certain sum; a speaking-trumpet should be used by him in cases of emergency, by which his voice might at once be known by the tone it would give it, his orders would then be more promptly obeyed. When necessary (and it is so too often), to pull down a building to arrest the progress of a fire, a distinct order should be given by some responsible person. To prevent confusion, any suggestion an influential character or other person at a fire might wish to make should be made through the director. At Constantinople the Sultan is required to attend personally at fires.

Should it be thought preferable to have the engine distinct from the pole and yard, particularly when the engines are small, a platform on trucks, about ten feet long by six or eight wide, would be required to transport them (this might precede the engine and carry the firemen); in this case, also, the short hose which is fitted to the yard and pole must be always kept properly fitted to them; and whenever the fire-escape is not wanted, the hose must be attached to an engine at the fire, a second may be carried up to the top of the pole to make it more effective.

If the above plan be worthy of adoption, then, in London or in places where soldiers are quartered, it should be their especial province to proceed on this *Polar* expedition to a fire on the first alarm being given. It may be observed, that since the establishment of the New Police in all the great towns, a space may always be kept clear for operations of this nature, which renders their adoption in the present day more feasible than heretofore.

In Russia every city is divided into districts (from personal observation, it is so at St. Petersburgh, Moscow, and Smolensko), each district having a watch-tower, from which signals are made on the instant a fire is discovered, with balls by day and lanterns by night, to indicate

* An English sailor would box this cross-jack yard about in style; indeed, no people make better firemen than our sailors. The Navy has distinguished itself at fires on shore, from St. Petersburgh to Constantinople.

the exact spot. The writer had just returned from that *despotique* but *systematique* country, when it was announced in the Morning Papers,* that the firemen had been galloping about London all night in search of a fire, which proved to their fatigued senses to be a brilliant Aurora Borealis, these northern lights or fire being extinguished by that mighty fire-engine the SUN at day light; had there been a fire in London in the opposite direction, it might have had a little more of its own way than usual. Church-steeples, and towers, with a look-out by a few of the New Police, would bring engines to act together in a short time, and our firemen with their horses might then repose until their services were required.

GEORGE SMITH, Capt. R.N.

Upper Crescent, Clifton, Oct. 1836.

P. S.—The hose running out to the end of the upper yard-arm is not shown in use in the engraving, as the fire-escape is in operation.

BRAITHWAITE'S FIRE-ENGINE.

Sir,—If it be true that the public is deprived of the additional security which Mr. Braithwaite offers by his ingenious application of steam power to the common fire-engine, by underhand and unfair means, it becomes a matter for the public; and the option of rejecting or accepting should not be allowed to rest with any "company," or body of directors of an insurance company. Much credit is undoubtedly due to those by whom the late arrangements and regulations of the fire-brigade have been effected; but these have been effected at a comparatively trifling expense, and much room still remains for further improvement. Now the question is, are we to be deprived of what reasonably appears an important additional security against accidents by fire? It would really seem that the matter stands thus, the Insurance Companies *v.* the Public Security.

Mr. Braithwaite, with an energy and enterprise which characterise that gentleman, has now brought his fire-engine to considerable perfection. It is, in every respect, adapted to practical purposes, and its efficiency and superiority over the common engine, cannot for one minute be questioned: nor, it appears, has any expense or labour been spared. The steam fire-engine has been tested and proved. Will our good masters, who encouraged and solicited Mr. B. to carry out his project, explain why they have subsequently thought fit to disclaim any interest in the matter, and shift the entire expense from their own shoulders? The public will be led to suspect there is "something rotten" in the constitution of Fire-insurance Companies; since it manifestly appears it is *not* their interest that life and property should be secured against casualties by fire, beyond a certain extent. Mr. Braithwaite has little cause to congratulate himself on the success which has attended his efforts hitherto. He must not rely on the munificence of Messrs. Barclay, Perkins, and Co., or the *patronage* (the word ought to be expelled the English language) of his *ci-devant* friends, who, at the eleventh hour, discover *they* can do better without his aid.

Mr. Braithwaite does well to make this matter public; let him meet the vacillating conduct of the insurance companies with a bold defiance. He has no cause to fear the result; nor is he, I suspect, solicitous to avoid it.

I am, Sir, your constant reader,

P. R.

Chiswell-street, Nov. 11, 1836.

M. GUESNEY'S NEW SYSTEM OF GEOLOGY.

Sir,—In your 682d Number, page 370, 371, an "Old Correspondent" sneers at the account of the description of the geological globe presented by Sir John Byerley to the Society for the Encouragement of Practical Science, Adelaide-street, and more particularly so at the idea of Edinburgh being due south of London in the course of 13,000 years, &c. Your mathematical correspondent, Kinclaven, in noticing the subject (No. 666, p. 460), remarks, that it is "another example of the periodical folly of some men." Now, Mr. Editor, although perhaps I may not be so deeply read in physical astronomy as Kinclaven, I will have devoted a large portion of my time to practical astronomy, and more particularly so to spherical trigonometry; and I think it will be no difficult matter to put

* Nov. 17, 1835. It is worthy of note, that the very day these remarks were printed the same thing occurred again.

Kinclaven in possession of the solution of a question by an eminent astronomer, Mr. Leadbetter, who shows that the present north pole star will in the year of Christ 15064, be 8° 56′ 49″ south of the zenith of London; and, consequently, London will be in lat. (90°−8° 56′ 49″) = 81° 3′ 11″ N.

In p. 477, vol. i. of Leadbetter's "Astronomy," he first calculates the nearest approach the pole star makes to the pole of our earth, allowing the precession of the equinox to be 50 seconds per year. The calculation abridged is as follows:—

	S.	D.	M.	S.		D.	M.	S.	
1727 long. of the pole star.....	2	24	45	31	lat.	66	4	11	N.
Subtract its long. from	3								
Pole is then short of Cancer	5	14	29						

Hence if 50″ : 1 year :: 5° 14′ 29″ : 377 years. Consequently, 1727 added to 377, gives 2104 years, or the pole of the earth will make its nearest approach to the pole star in the year of Christ 2104. Again,

	D.	M.	S.	
Latitude of the pole star	66	4	11	N.
Obliquity of the ecliptic add.....	23	29	0	
Pole's declination	89	33	11	N.

Also if 50″ : 1 year :: 180° :: 12960 years, that is, in 12,960 years the north pole-star, and every fixed star, will move half way round the heavens. Hence, finally,

	D.	M.	S.	
Pole's declination when in Cancer is	89	33	11	N.
Distance of the two tropics sub.....	46	58	0	
Pole's declination when in Capricorn	42	35	11	N.
Declination of the zenith of London	51	32	0	
Distance of the pole star south of the zenith of London	8	56	49	

Consequently, as before stated, London will in the year of Christ (12960 + 377) 15064, be in lat. 81° 3′ 11″ N. Now, the latitude of Edinburgh is 55° 58′ N.; hence 55° 58′ − 42° 35′ 11″ = 13° 22′ 49″; hence Edinburgh will be in lat. (90 − 13° 22′ 49″) 76° 37′ 11″ N, or Edinburgh will be (81° 3′ 11″ − 76° 37′ 11″) 4° 26′ south (I do not say due south) of London in the year of Christ 15064. If Kinclaven should deny the truth of this, and show that it is false, then I will confess I have studied for no purpose.

I am, Sir, your obedient servant,

O. N.

SOLUTION OF O. C. F.'S QUESTION.

Let m be the price of one egg of the dearest kind, n that of one of the other, and P the selling price of one; a = number in the first parcel, x = number in the second. Then by the first condition of the question, $mx + nx = (a + x)$ P or $x = \frac{m - P}{P - n} a$.

2d. Let R = 1 + the proposed gain upon it; then $R(mx + nx) = (a + x)P$: hence $x = \left(\frac{Rm - P}{P - Rn}\right) a$.

It is evident that Rm must always be greater than P, for if $Rm = P$, or less than P (then $P > Rn$); then in the one case the value of x would be infinite, and in the other it would be negative. $\therefore Rm > P$, but when $Rm > P$, $P > Rn$, or $R < \frac{P}{n}$. Now, by the question, $m = \frac{1}{2}$, $n = \frac{1}{3}$, $P = \frac{2}{5}$, $a = 120$ $\therefore$ the first value of x will be,

$$x = \left(\frac{m-P}{P-n}\right)o = \left\{\frac{\frac{1}{2}-\frac{2}{5}}{\frac{2}{5}-\frac{1}{3}}\right\}120 = 180.$$

That is, if 120 at 2 a penny be mixed with 180 at 3 a penny, and the whole sold at 5 for twopence, there will be neither gain nor loss. Further, since $R \angle \frac{P}{n}$ $\therefore R \angle \frac{2}{5} \div \frac{1}{3}$, that is, $R \angle \frac{6}{5}$, or 1·2, that is, he cannot gain 20 per cent.

Assuming, therefore, R = 1·1, 1·15, 1·19, the respective values of x from the equation $x = \left(\frac{Rm-P}{P-Rn}\right)o$ will be 540, 1260, and 7020, respectively.

Nor can he lose 20 per cent., for R m must always be greater than P, or $R \rangle \frac{P}{m}$, or $R \rangle \frac{2}{5} \times \frac{2}{1} = 8$, that is, the loss cannot be 20 per cent.; therefore, where there is a mixture, the gain or loss may be any thing short of 20 per cent.

It may also be observed, that if the selling price P is greater than m, there will always be a gain. Thus, suppose $P = \frac{3}{5}$, m, n, and a, as before, then $R \angle \frac{P}{n}$, or less than $\frac{3}{5} \times \frac{3}{1} = 1{\cdot}8$, that is, the gain cannot be 80 per cent. in the same way, R $m \rangle$ P, or $R \angle \frac{P}{m}$, or greater than $\frac{3}{5} \times \frac{2}{1} = 1{\cdot}2$, that is, the least gain must be more than 20 per cent. Suppose the gain to be 50 per cent., then

$$x = \left\{\frac{1{\cdot}5 \times \frac{1}{2} - \frac{3}{5}}{\frac{3}{5} - 1{\cdot}5 \times \frac{1}{3}}\right\}120 = 180.$$

The above question might have been solved without the assistance of algebra, by certain rules given in some books of arithmetic; but to discuss it through all its bearings (and that I have perhaps not fully done), is much easier done by algebra.

Yours, &c.

AN OLD CORRESPONDENT.

THE MACKINTOSHIAN THEORY.

Sir,—I am truly sorry to learn from Kinclaven's last communication, that he has been suffering from indisposition. I respect him as an able and honest opponent ought to be respected. I could plainly perceive, as he himself declares, that he had "paid no small degree of attention to the Newtonian system," and can appreciate the talent with which he defends that system; whilst, at the same time, I contend that the system itself is founded upon imaginary axioms and arbitrary phrases, representing physical conditions which have no real existence. Kinclaven cannot divest himself, it appears, of the impression, that the "electrical theory" has been conceived and advanced in a spirit of opposition, and that the ulterior object is the overthrow of the Newtonian system. In this view he is wholly and entirely mistaken. The respect which the author of the electrical theory entertains for the memory of the illustrious founder of that system, is as pure and profound as that of Kinclaven's, or any other individuals either is or can be; but he is not, on that account, prepared to sacrifice the cause of truth at this shrine of adoration. However great may be his respect to the memory of the founder of that system, his respect for truth is more. He claims for himself the right to examine freely the opinions or principles of any man who has ever lived, and as freely concedes the same right to others. My observation that the attacks of Kinclaven upon the electrical theory were conducted with more asperity than to me appeared needful, related chiefly to his *manner* of attack. As an instance, in his last communication he says, "Now, if we could force ourselves to believe in Mr. Mackintosh's theory, we must admit that the Supreme Architect himself is unacquainted with eternal or perpetual motion; for notwithstanding all the care he has taken to preserve the rotary and revolving motions as long as possible, still both must come to an end, and the 'earth cease to revolve upon her axis.' Mr. Mackintosh, in fact, tells us, that the rotary motion of the moon has already ceased!—(No. 645, p. 233, 234.) It is strange (if true) that none of our astronomers have thought proper to give us any information of this astounding fact; *or has Mr. Mackintosh merely made this assertion for the purpose of trying*

how far he could play upon the credulity of some of his readers (friend Ursa for one)? Or it may be (for I would not wish to deal harshly with him), that he had not duly considered the subject when he made this strange assertion."

The spirit and manner here displayed reflect very little credit upon the writer; they are wholly unworthy of any individual aspiring to the rank to which Kinclaven is fairly entitled in the scientific world; and would not have been adopted by a fair and candid opponent. If Kinclaven thinks that the system which he advocates will be advanced in the estimation of sober and intelligent minds by this *mode* of attack, he will find at last that he calculates very erroneously.

However strange it may appear to Kinclaven, the subject was duly considered before the assertion was made, that the moon had ceased to revolve upon her axis. Did Kinclaven ever see a fly-wheel without a rim, and with four heavy leaden balls attached to the extremities of the arms or spokes for the purpose of generating momentum—there are such fly-wheels;—and if we say that the moon revolves upon her axis, in the same sense it may be said that the leaden balls, which are fixed at the extremities of the arms of the fly-wheel, revolve upon their axis as the wheel revolves; the same side of the leaden ball is always presented to the centre of revolution, and the same side of the moon is always presented to the earth or centre of revolution, *and* the electrical theory assigns a cause for this constant effect.

Kinclaven has, much to his credit, lowered his tone from that positive dogmatic style so conspicuous in his early communications upon the electrical theory. He begins to perceive that the system which he has undertaken to advocate will not bear the test of severe scrutiny. With respect to Newton's first law of motion, he says, "He might, perhaps, have been induced to assert the truth of this law, by knowing that the planets have continued in motion for ages, without any perceptible diminution of their velocity." Now this cannot be called a demonstration exactly; we must, therefore, take it for just as much as it is worth. It would be unreasonable to expect a demonstration, where none can be given.

Kinclaven very carefully avoids the mention of any thing relating to "*the first impulse;*" he must be very sensible that a demonstration is required for this proposition. Professor Robinson, too, is introduced, to inform us that "*every change is an effect;*" and that in reference to centrifugal and centripetal forces, the mind invariably contemplates them as effects. It appears, then, that the word *force* does not truly represent the idea intended to be conveyed, and that the terms *centrifugal effect* and *centripetal effect* are more appropriate, as contemplating the effects only, without any references whatever to the causes from which those effects are or may be derived.

Kinclaven requests me to point out any proposition in the *Principia* depending on the first law of motion, and to show that it is inconsistent with facts deduced from astronomical observations. In my opinion enough has been already advanced, to show that the facts are not deducible from the principles; and as the facts are our only sure guide, I come at once to the general conclusion, that the principles are erroneous. No man can fairly deduce the facts, as they are known to exist from the combined action of momentum and gravity, unless it be assumed that the motions of the heavenly bodies are to remain for ever fixed quantities, notwithstanding the unceasing efforts of gravity to destroy the motion.

I will endeavour to draw this part, at least, of the controversy to a point. MOTION IS NOT A FORCE, BUT IS DERIVED FROM A FORCE. Now, tell me, Kinclaven, from what force is the motion of the heavenly bodies derived? That force which could impart motion in the first instance can sustain that motion, and is required to do so, as otherwise the motion would be quickly annihilated by the action of gravity.

I remain, Sir, yours respectfully,

T. S. MACKINTOSH.

MR. SYMINGTON AND MR. HOWARD.

Sir,—If Mr. Howard cannot understand the meaning of his own descriptive phrases, contained in your pages, surely it is no fault of mine, as I have told him, in his own words, what I saw at Tedworth, and what was practised 40 years ago at Newcastle. Having done so, I leave him to satisfy himself of the correctness

of my information, as I am afraid no description which I could give would be deemed sufficient by one so obstinately bent on remaining in error.

To bring this correspondence, not nearly, but altogether, to an end, as even Mr. Howard seems tired of his repetitions, I have to say, that I am not aware of ever having had the presumption to lay claim to the invention of the principle of condensing by injection; a fact of which Mr. Howard "*ought* not to have been ignorant," as he seems to have bestowed some little attention on my circular contained in your pages. That Mr. Howard has not had leisure to inspect my specification, I have no hesitation in believing; and I dare say he will remember I gave it as my opinion, that his first communication was got up in haste. That I have only done him justice in so conjecturing, he has himself most amply proved by his own admission—that notwithstanding all the outcry he has been making, and the charges he has been advancing, he has not yet "had leisure to inspect my specification!" Now, according to Mr. Howard's notions of completeness, this may be doing me ample justice; but I doubt he will have some little difficulty in persuading others, that he had properly prepared himself for so positively declaring his invention and mine to be similar. Mr. Howard has informed your readers that my referring to these drawings and specification is admitting the weakness of my cause. By what principle, process, or method of reasoning, he has arrived at such a conclusion, I am at a loss to determine, as I have always believed it to be understood *generally* that veritable, tangible documents were more valuable than mere assertions; although I have no doubt there are many instances where such as have a purpose to serve, or a wish to appropriate to themselves what they have no right to, may find facts extremely inconvenient and perplexing. That Mr. Howard thinks his method the best I will not dispute, but I suspect he will speedily be undeceived, as surely the getting rid of a portion of the machinery occupying space in a sea-going cargo-carrying vessel, and the adding to it, must be very dissimilar.

That I may part in amity with Mr. Howard, I would direct his attention to the following dissimilarities in the two inventions, which may be sufficient to set the question at rest, without causing you to lose your valuable time in answering irrelevent questions. First, the refrigerating by means of water applied outside the ship, instead of carrying cold water within the ship, whereby space must be gained and weight avoided. Second, the non-necessity for any additional pumps for supplying the refrigerating pipes, whereby space is gained, weight avoided, and power saved. Third, the making use of the air-pump and hot-well in the usual way. Fourth, the momentary readiness with which the old plan, that is, the one in common use at present, can be resorted to, while the principle of condensation remains unaltered.

A few words more, and I have done. Mr. Howard is perfectly "welcome" to the "simple contrivance" he has carried into effect on board the "Vesta," for preventing the air-pump being choked. "If, in *itself*, it be found *new* or advantageous," I would suggest, that if his plan accomplishes all that can be desired, it will be most unreasonable to attempt to make it do more, even by altering "detail."

Your most obedient servant,

WILLIAM SYMINGTON.

1, King William-street, Nov. 8, 1836.

REPORT OF THE SELECT COMMITTEE APPOINTED TO INQUIRE INTO THE BEST MEANS OF EXTENDING A KNOWLEDGE OF THE ARTS AND OF THE PRINCIPLES OF DESIGN AMONG THE PEOPLE (ESPECIALLY THE MANUFACTURING POPULATION) OF THE COUNTRY; ALSO TO INQUIRE INTO THE CONSTITUTION, MANAGEMENT, AND EFFECTS OF INSTITUTIONS CONNECTED WITH THE ARTS.

The Committee have pursued (amid frequent interruptions caused by the numerous private Bills introduced in the present session) the inquiry left unfinished by them in the last session of Parliament.

In taking a general view of the subject before them, the Committee advert with regret to the inference they are obliged to draw from the testimony they have received; that, from the highest branches of poetical design down to the lowest connexion between design and manufactures, the arts have received little

encouragement in this country. The want of instruction in design among our industrious population, the absence of public and freely open galleries containing approved specimens of art, the fact that only recently a National Gallery has even been commenced among us, have all combined strongly to impress this conviction on the minds of the Members of the Committee. In many despotic countries far more development has been given to genius, and greater encouragement to industry, by a more liberal diffusion of the enlightening influence of the arts. Yet, to us, a peculiarly manufacturing nation, the connexion between art and manufactures is most important;—and for this merely economical reason (were there no higher motive), it equally imports us to encourage art in its loftier attributes; since it is admitted that the cultivation of the more exalted branches of design tends to advance the humblest pursuits of industry, while the connexion of art with manufacture has often developed the genius of the greatest masters in design.

The want of instruction experienced by our workmen in the arts is strongly adverted to by many witnesses. This deficiency is said to be particularly manifest in that branch of our industry which is commonly called the fancy trade; more especially in the silk trade; and most of all, probably, in the ribbon manufacture. Mr. Martin (the celebrated painter) complains of the want of correct design in the China trade; Mr. Papworth (an eminent architect) of its absence in the interior decorative architecture of our houses; and in furniture. Hence the adoption of the designs of the era of Louis XV. (enormously dignified with the name of Louis XIV.), a style inferior in taste and easy of execution. To a similar want of enlightened information in art, Mr. Cockerell attributes the prevailing fashion for what is called Elizabethan architecture; a style which (whatever may be the occasional excellencies of its execution) is undoubtedly of spurious origin.

This scanty supply of instruction is the more to be lamented, because it appears that there exists among the enterprising and laborious classes of our country an earnest desire for information in the arts. To this fact, Mr. Howell, one of the factory-inspectors, has borne ample testimony. Mr. Morrison, a Member of the House of Commons, has given evidence to the same effect. The ardour for information is apparent in Birmingham, Sheffield, and in London; and the manufacturing workmen in the neighbourhood of Coventry have (to their great honour) specifically petitioned the House of Commons for instruction in design.

It has too frequently, if not uniformly, occurred, that the witnesses consulted by the Committee have felt themselves compelled to draw a comparison more favourable (in the matter of design) to our foreign rivals, and especially to the French, than could have been desired, either by the Committee or the witnesses.

The Committee were anxious to investigate the pervading cause which seemed to justify this conclusion. It appears that the great advantage which foreign manufacturing artists possess over those of Great Britain, consists in the greater extension of art throughout the mass of society abroad. Art is comparatively dear in England. In France it is cheap, because it is generally diffused. In England a wealthy manufacturer has no difficulty in procuring superior designs. Our affluent silversmith have called to their aid the genius of Flaxman and of Stothard. But the manufacturer of cheap plate and inferior jewellery cannot procure designs equal to those of France, without incurring an expense disproportioned to the value of the article on which his labour is employed.

According to the evidence of M. Guillotte, a maker of Jacquard looms (a gentleman who does the fullest justice to the English manufacturers), a French capitalist employs three or four artists, where in England one artist would supply eight or ten manufacturers. This is exemplified in the process called by the French the "*mise en carte*," or the practical transfer of the pattern to the fabric into which it is to be wrought. It appears that in England the designer of the pattern and the person who applies it to the manufacture are distinct persons. In France the workman is himself the artist.

The French have long been celebrated for their attention to design in manufactures. Their zeal in this pursuit is no where more manifest than in their recent prosecution of the shawl trade,—in the introduction both of the material and pattern of the Cachemire shawl by M. Ternaux, and in the later investigations of M. Couder. M. Couder has established a school for shawl designs at Paris; he has succeeded in tracing the original designs on the shawls of Cachemire through all the imperfections of the native manufacture, and supplied his country with the genuine pattern.

Much importance has justly been attributed to the schools of design so generally diffused through France. These schools (in number about 80) are superintended by the Government. The free, open, and popular system of instruction (prevalent in France since the days of Colbert), and the extreme accessibility of their museums, libraries, and exhibitions, have greatly tended to the diffusion of a love of art, as well as of literature, among the poorer classes of the French.

The testimony of Dr. Bowring, M.P., on this subject, will be consulted with interest and advantage.

According to the evidence of a distinguished foreigner, Dr. Waagen, the intelligent administration of Prussia has felt the necessity of paying great attention to the instruction of the Prussian manufactures in art. The description of the "*Gewerb-Institut*," at Berlin, which was founded with this view, will be read with interest in the evidence of Dr. Waagen. It appears that a constant correspondence is maintained between this institution and the more distant local governments and local manufacturers. In Bavaria (now the classic country of the arts) there are thirty-three schools of design. Outline drawing, to a considerable extent, forms an element in the system of national education.

The Committee intended to have laid before the House, returns received through the medium of the Foreign-office, explanatory of the different schools and institutions connected with the arts in foreign countries. The non-arrival of the returns from France and from Prussia has caused the production of these documents to be postponed to a future session.

In our own country, manufacturing artists have been greatly indebted to such institutions as the Board of Trustees in Edinburgh and the Royal Society in Dublin (the latter of which has this year come under the consideration of another Committee of the House of Commons). In England the rising Institute of British Architects promises great advantage to our manufacturers, and the more matured mechanics' institutions have disseminated much valuable instruction in the arts. The reports of the mechanics' institutes of Glasgow, Manchester, and Coventry indicate, in the present year, the awakened attention of the inhabitants of those great towns to the importance of education in design.

His Majesty's Government has this year, for the first time, proposed a vote in the estimates for the establishment of a Normal school of design.

It appears to the Committee that, in the formation of such an institution, not mere theoretical instruction only, but the direct practical application of the arts to manufacture sought to be deemed an essential element. In this respect, *local* schools, where the arts reside as it were with the manufacture to which they are devoted, appear to possess many practical advantages. In such situations it is probable that the arts will eventually strike root and vegetate with vigour. But if a more *central* system be adopted, the inventive power of the artist ought equally to be brought to bear on the special manufacture which he is destined hereafter to pursue. This principle is judiciously adopted in the *Gewerb* institution at Berlin in which, after one year of general instruction in art, the pupil selects a branch of manufacture as his trade, and passes two years in the practical application of art to the peculiar manufacture which he has chosen. Unless the art and manufactures be practically combined, the unsuccessful aspirants after the higher branches of the arts will be infinitely multiplied, and the deficiency of manufacturing artists will not be supplied.

Perhaps the Government would most judiciously interpose not only by creating a Normal school, but by applying to local institutions the species of assistance now extended to the building of school-houses. It is worthy of consideration whether, if satisfactory evidence were given that the local residents or municipalities would supply a certain portion of the expense, contributions, in aid only, might not be judiciously supplied by Government. But the interposition of the Government should not extend to interference; it should aim at the development and extension of art; but it should neither control its action, nor force its cultivation.

The same system might probably be beneficially extended to the formation of open Public Galleries or Museums of Art in the various towns willing to undertake a certain share in the foundation, and to continue the maintenance, of such establishments. In nothing have foreign countries possessed a greater advantage over Great Britain than in their numerous public galleries devoted to the arts, and open gratuitously to the people. The larger towns of France are generally adorned by such institutions. In this country we can scarcely boast of any. Our exhibitions (where they exist) are usually periodical. A fee is demanded for admission, and modern works only are exhibited. From such exhibitions the poor are necessarily excluded. Even those who can afford to pay seldom enjoy the advantage of contemplating perfect specimens of beauty, or of imbibing the pure principles of art. If the recommendation of the Committee were adopted,—that the opening of public galleries for the people should, as much as possible, be encouraged,—casts of the best specimens of sculpture might be advantageously transmitted from the metropolis to the different towns. Casts are cheaply supplied in Paris under the superintendence of an artist; and a *tarif*, indicating their several prices, is issued for the benefit of the public. This example is worthy of imitation. But, besides casts and paintings, copies of the Arabesques of Raphael, the designs at

Pompeii, specimens from the era of the revival of the arts, every thing, in short, which exhibits in combination the efforts of the artist and the workman, should be sought for in the formation of such institutions. They should also contain the most appoved modern specimens, foreign as well as domestic, which our extensive commerce would readily convey to us from the most distant quarters of the globe.

It appears that among our workmen a great desire exist for such public exhibitions. Wherever it be possible, they should be accessible after working hours; and admission should be gratuitous and general. A small obstruction is frequently a virtual prohibition. The vexatious fees exacted at Westminster Abbey, St. Paul's, and other public buildings, are discreditable to the nation. In the Abbey at Westminser, not only is a fee demanded at the door, but supplementary fees are extorted in different portions of the building.

An intelligent witness, Mr. Nasmyth, suggests the great advantage which manufacturers would derive from themselves encouraging a knowledge and a love of art among their workmen. The exhibition of works of proportion and of beauty in rooms connected with factories would have a beneficial effect on minds already familiar with geometrical proportions. Scientific improvements in machinery, and economy in the construction of it, are both intimately connected with perfection of form. The geometrical forms of the works of antiquity (especially in their relation to the ellipse) are referred to by Mr. Nasmyth, and more fully developed by Mr. Reinagle. Mr. Cowper has shown that the application of art to a material not only encourages but sometimes creates a manufacture. Were the arts more extensively diffused among our population, many articles, such as marble, tera-cotta, wood, and ivory (a material to which art is much applied in France), would give additional employment to the people.

It has been generally admitted, both by artists and by manufacturers, that access to botanical gardens would have an excellent effect on our industrious population. The French study more closely than we do the living flower, and their imitations of plants are generally acknowledged to be more correct than ours. Mr. Hay, an intelligent practical witness, from Edinburgh, has dwelt on the importance of the study of the natural flower, even in its simplest form.

Among the advantages possessed by the manufacturing artists of foreign countries, the attention of your Committee has been directed to the books on art, published by the Governments for the instruction of their workmen. Among these works issued by M. Beuth, director of the *Gewerb-Institut* at Berlin, particularly deserve to be mentioned.* These works, printed at the expense of the Prussian Government, with copper-plate engravings, make known to the manufacturing artist the most beautiful models of antiquity and the era of the *Renaissance*, as well as Oriental and Moresque designs. Architectural illustrations, both for the exterior and interior of building, vases, tripods, pateræ, patterns for various species of manufacture, form one of these volumes. The other is devôted to plans and illustrations of the construction of the public works of Prussia.

The chief excellence of these works appears to consist in their general correctness and classical purity of taste. It is gratifying to observe, that British captital and intelligence, unaided by the Government, have been turned in the same direction. Cheap publications upon art are studied with interest by our workmen. The "Mechanics' Magazine" has, in this point of view, as well as in its more scientific character, conferred lasting advantages on the manufacturers of the country. The immensely-extended publication of specimens of art by means of the steam-printing machine is justly commemorated in the evidence of Mr. Cowper. The "Penny" and "Saturday" Magazines, the "Magasin-Pittoresque," the "Magasin-Universel," and other cheap works issued in France and Germany, are mainly indebted for their success to this great instrument of knowledge. Nothing is more cheering than to find public instruction, and consequently public happiness, thus extending with the increase of national capital, and conveying intelligence and civilisation in so cheap a form to the remotest cottage in the kingdom. Such instruments may be said to form the paper-circulation of knowledge; and, while the friends of education lament that the people are yet most insufficiently provided with places of instruction, they are somewhat consoled by the reflection that these works convey instruction to the very dwellings of the people.

But though cheap publications are thus circulated by individual enterprise, there

* Vorbilder für Fabrikanten und Handwerker. By Professor Beuth, Berlin.

Bau-ausführungen des Preussischen Staats. By the same.

To which may be added,—

Ornamente aller classischen Kunst-epochen, nach den originalen. An excellent work, by Professor Zahn, Berlin.

Several other German works, on the same subject, are mentioned in the evidence of Mr. Morant, Part II.

are works, such as those issued by the Government of Prussia, which probably require too great labour of design, and are too expensive of execution, to be profitably undertaken by individuals. It is stated, on the high authority of Baron Von Klenze, that the influence of Professor Beuth's publications is already perceptible in the shops and dwelling-houses at Berlin. Encouraged by the success of this experiment, the Bavarian Government is about to issue similar, but cheaper, works for the benefit of the workmen of Bavaria.

It appears to the Committee most desirable, with a view to extend a love, a knowledge of art among the people, that the principles of design should form a portion of any permanent system of national education. Such elementary instruction should be based on an extension of the knowledge of form, by the adoption of a bold style of geometrical and outline-drawing, such as is practised in the national schools of Bavaria. The committee further would suggest that, if the proper machinery for accomplishing such an object were supplied, the progress of the people in the arts should be reported annually to Parliament. This part of the subject, however, is involved in the much greater question of a responsible minister of education; which the limits imposed on the committee prevent them from doing more than alluding to. It is with regret that your committee notice the neglect of any general instruction even in the history of art at our universities and public schools; an omission noticed long ago by Mr. Burke, and obvious to every reflecting mind.

The Committee turn to another branch of the subject connected with arts and manufactures. The difficult and delicate question of copyright has already engaged the attention of the House; and numerous complaints of want of protection for their designs have been laid before the Committee by artists and manufacturers. Mr. Smith, an eminent manufacturer of Sheffield, states, that the piracy of his designs will compel him altogether to abandon designing as connected with his trade. A similar or corroborative statement is made by architectural sculptors, modellers, manufacturing artists, and artists generally. Mr. Martin has been seriously injured by the piracy of his works; and Mr. Papworth attributes to the want of protection for inventions the absence of original matter in tablets, vases, and foliages; of which in England we possess few specimens, and perhaps none worthy of observation. It is well known that a short period of copywright is extended to printed cotton patterns. A doubtful protection has also been afforded to the arts by the statutes 38 Geo. III. c. 71., and 54 Geo. III. c. 56. The copyright given by these statutes extends to metallic figures of men and animals, to figures combined of the two, and to what is somewhat loosely styled "matter of invention in sculpture." Metallic foliages, arabesques, vases, candelabra, and similar works are unprotected by them. Whatever be the legal latitude of these Acts, the expensiveness of a remedy through the courts of law or equity is a virtual bar to invention, and almost affords impunity to piracy in art.

The most obvious principle of any measure enacted for the protection of invention appears to be the constitution of a cheap and accessible tribunal. The French have long possessed a prompt and economical Court of Judgment for cases of this kind. The constitution of the *Conseil des Prud' hommes*, prevalent in the manufacturing districts of France, is a subject of interesting development in the evidence of Dr. Bowring. These local tribunals form a kind of jury or board of arbitration, composed of master-manufacturers and workmen, empowered to decide on priority of invention in design, as well as on many other subjects connected with manufactures. It has however occurred to the Committee, that where a dispute arises concerning originality of invention between designers residing at a distance from each other, local tribunals would not readily afford a final abjudication.

In addition to cheapness, the greatest promptitude of decision is another obvious element in the constitution of such a tribunal. For this and for other reasons a system of registration appears to be indispensable.

Another element in the consideration of this subject is the varying duration of protection to be extended to different inventions in manufactures. The varying periods of protection form a question of minute and exact detail, fit for separate investigation, and dependent on evidence too specific to be comprehended in the mere general inquiry undertaken by the Committee.

The Committee consider the elaboration of any comprehensive measure for the protection of designs in manufactures to be well worthy of the serious attention of the Government.

The arts, both generally and in so far as they are connected with manufactures, have shared the common suffering under the baneful influence of fiscal duties. The Excise laws, in their restrictions on the manufacture and the form of bricks, have obstructed the exercise of art in that material. The window-duty acts injuriously on the proportion and beauty of our buildings.

The paper-duty has been extensively detrimental in its effects on periodical publications on the arts, on the use of drawing-paper, on the employment of cards in the Jacquard loom, and in its oppressive application to the whole trade of paper-staining. The glass duties have fettered the arts in their endeavours to restore painting on glass, in which (contrary to common belief) we are able to surpass the artists of former times. The same duties have restricted the adoption of engravings as ornaments in dwelling-houses. The lower cost of glass in France has encouraged a much more extended use of engravings in private residences.

In reference to the diffusion of a knowledge of the arts, your Committee have already adverted incidentally to exhibitions. Among exhibitions connected with the encouragement of art, their attention has been called to the institutions established in Germany under the name of *Kunst Vereine*, and now becoming prevalent in this country. These associations, for the purchase of pictures to be distributed by lot, form one of the many instances in the present age of the advantages of combination. The smallness of the contribution required brings together a large mass of subscribers, many of whom without such a system of association would never have been patrons of the arts. Messrs. Waagen and Von Klenze highly estimate the advantages conferred on the arts by such associations, which appear to have been introduced into Prussia by M. Von Humboldt.

From the subject of exhibitions the Committee have naturally been led to inquire into the constitution and management of those institutions which have prevailed in Europe for the last two hundred years, under the name of academies. Academies appear to have been originally designed to prevent or to retard the supposed decline of elevated art. Political economists have denied the advantages of such institutions, and artists themselves, of later years, have more than doubted them. It appears, on the evidence of some of the witnesses, that M. H. Vernet, the celebrated Director of the French Academy at Rome, has recommended the suppression of that establishment. It is maintained by Dr. Waagen, that what is called the academic system gives an artificial elevation to mediocrity, and that the restriction of academic rules prevents the artist from catching the feeling and spirit of the great master whom he studies; like the regulations of those literary institutions of former times which set more value on scanning the metres of the ancients than on transfusing into the mind the thoughts and feelings of the poet. Many of the witnesses concur with Dr. Waagen in the opinion that academies ought properly to be schools only; wherein such instruction may be given as is not attainable in the *studio* of a private master. When academies go beyond this, their proper province, they degenerate into mannerism and fetter genius; and when they assume too exclusive and oligarchical a character, they damp the moral independence of the artist and narrow the proper basis of intellectual excellence—mental freedom.

It seems probable that the principle of free competition in art (as in commerce) will ultimately triumph over all artificial institutions. Governments must, at some future period, content themselves with holding out prizes or commissions to the different but co-equal societies of artists, and refuse the dangerous gift of pre-eminence to any. It is more than probable that our Royal Academy is indebted for the distinguished names which adorn its annals to the necessity of competing, as a private society, with other institutions, rather than to the extraneous distinctions and privileges with which it is decorated, and, perhaps, encumbered. As it stands, it is not a public national institution like the French Academy, since it lives by exhibition, and takes money at the door. Yet it possesses many of the privileges of a public body, without bearing the direct burthen of public responsibility.

The artists examined by the Committee frequently concur in admitting the eminence of the present and of former members of the Royal Academy; but they complain of the exclusive nature of its rules, of the limitation of its numbers, and of the principle of self-election which pervades it. Among its exclusive rules has been named one which prohibits the members of the Academy from belonging to any other institution of artists in London; and another which restricts a candidate for academic honours from exhibiting beyond the walls of the Academy. It is true that the inexpediency of the former of these regulations is acknowledged on the part of the Academy; but it still exists, and has recently been carried into execution. The private and irresponsible nature of the proceedings of the Academy; the privilege enjoyed by the Academicians of exclusively consorting with the patrons of art at the annual dinner; their prerogative of retouching their own works previous to exhibition (a power denied to the other artists who exhibit), and the monopoly of the best places by the pictures of the Academicians, have been adverted to by various witnesses. Of the privileges above-named some have been denied to be exclusive; others have been

claimed by the Academy as essential to the nature of such an institution.

It is certainly to be lamented that artists so distinguished as Mr. Martin and Mr. Haydon should complain of the treatment of their works within the walls of the Academy; and particularly that Mr. Martin should declare that his paintings have found that encouragement in the foreign exhibitions of France and Belgium which they have been denied at home.

Some irregularities have been noticed in the delivery of lectures at the Academy. The neglect of architecture has been complained of by several artists *extra muros;* and the inadequacy of the instruction given in that important branch of art is admitted by the President himself.

The exclusion of engravers from the highest rank in the Academy has often called forth the animadversions of foreign artists. In the French Academy engravers are admitted into the highest class of members, So are they in Milan, Venice, Florence, and in Rome. In England their rise is limited to the class of associates. This mark of depreciation drove such eminent men as Woollett, Strange, and Sharpe far from the Academy. Such a distinction seems the more extraordinary, because British engraving has attained a high degree of excellence. Foreigners send pupils hither for education; and the works of British engravers are diffused and admired throughout the Continent.

The remarks of foreign critics have frequently been elicited by the unusual predominance of portraits over other works of art in our annual academic exhibitions. It appears (from the returns appended to the Report) that fully half of the paintings annually exhibited have been portraits, which often inconsistently obtrude themselves before ideal and historical compositions. In the arrangement of a national exhibition a more appropriate classification ought surely to be adopted.

The plan annexed to the evidence of Mr. Wilkins will explain that fully one half of the new National Gallery has been given up to the Royal Academy. Against this apportionment of the national building, a large number of artists have remonstrated; and two bodies of painters have petitioned the House of Commons on the subject. They declare their inability to compete with an institution so favoured at the public expense. It is true that the Academy may be compelled to quit the National Gallery whenever public convenience requires their removal; but the great body of non-academic artists contend that a society, which possesses not only this but many other public advantages, ought to be responsible to those who contribute to their exhibitions, and whose interests they are supposed to represent. A strong feeling pervades the artists generally on this subject. They are uneasy under the ambiguous, half-public, half-private, character of the Academy; and they suggest that it should either stand in the simple position of a private institution, or, if it really represents the artists of Great Britain, that it should be responsible to, and eligible by them.

Few circumstances can more fully exhibit the hitherto exclusive nature of our institutions than the fact that we have only just begun to form a National Gallery. The new building, now nearly completed, has been thrown back to open the façade of St. Martin's to Pall-mall,—an alteration in his original design which the architect much deplores. It is to be lamented that the whole edifice is not fire-proof. The portion allotted to the Royal Academy is not so. As, according to the plan, the officers and servants of the Academy reside on the premises, there will be fires in the academic portion of the building; a circumstance which must more or less endanger the adjacent national collection. In the construction of the new Picture Gallery at Munich (described in the evidence of Baron Von Klenze) the removal of all danger from fire seems to have been particularly attended to.

The description of the magnificent Galleries of Sculpture and Painting at Munich given by Baron Von Klenze, at the end of the Evidence, will be read with interest and instruction.

The subject of a Catalogue, or description of the paintings, is an important element in a national collection. Besides a *catalogue raisonné*, Mr. Waagen, in the Berlin Gallery, and Baron Von Klenze, in the gallery at Munich, have placed in each compartment of the gallery a descriptive map of the walls, by reference to which the spectator derives some brief information respecting the several pictures and their painters. It appears to the Committee that the most ready and compendious information would be given to the public by fixing its name over every separate school, and, under every picture, the name, with the time of the birth and death, of the painter; the name also of the master, or the most celebrated pupil, of the artist, might in certain cases be added. This ready (though limited) information is important to those whose time is much absorbed by mental or bodily labour. For their sakes, also, it is essential that the gallery be opened, in summer, after the usual hours of labour. It is far better for the nation to pay a few additional attendants in the rooms, than to close the doors on the laborious classes, to whose recreation and refinement a national collection ought to be principally devoted.

It appears to your Committee, that some portion of the gallery should be dedicated to the perpetuation and extension of the British

School of Art. Pictures by living British artists of acknowledged merit might, after they have stood the test of time and criticism, be purchased for the national collection; especially such paintings as are more adapted, by their style and subject, to a gallery than a cabinet. A room might also be devoted to such engravings as have undergone a similar probation of public criticism. This encouragement appears to be due to the higher branches of engraving.

It would be a great public benefit if the celebrated Cartoons from Hampton Court could be deposited in the National Gallery. That they could be preserved there with safety is the opinion of several eminent artists.

Your Committee observe with regret, that the great picture of Sebastian del Piombo has been exposed to the hazard (from the incursions of insects) detailed in the Evidence.

With respect to the future extension of the national collection, it has been suggested that individuals might be encouraged to bequeath to it money as well as paintings, by inscribing over the works purchased with their bequests the names of the donors.

It has been recommended by more than one experienced witness, that the pictures particularly sought for in our national collection should be those of the era of Raphael, or of the times just antecedent to it; such works being of a purer and more elevated style than the eminent works of the Caracci. Paintings of the Raphael era form the best nucleus of a gallery; they have been sought for on this account as the basis of the new National Gallery at Berlin.

The capability of the persons appointed to make purchases for the National Gallery is a very important question. It would seem that the majority of trustees ordinarily selected for such purposes in this country are chosen rather on account of their elevated rank and their possession of pictures than for any peculiar professional ability. A private collector may be an excellent judge of cabinet-paintings; but he may not have the comprehensive knowledge required in the choice of a national collection. In the Committees appointed to purchase paintings for the national galleries of France and Prussia, there is a greater admixture of artists and of *experts*, or persons who have devoted themselves to the study of the value of pictures. A similar admission of practical and professional critics is, in the opinion of the Committee, desirable in this country.

The composition of our Commissions for deciding on plans for public works, has also been, with great apparent justice, complained of. In France the tribunal which decides between competing artists is less limited and more professional. The opinion of the public is also there called in aid of the tribunal. It appears from the evidence of Mr. Cockerell that, on occasion of a recent *concours* for a public commission in Paris, the plans of the different artists were subjected to general public criticism for eight days; after which a tribunal, consisting of artists in general, as well as of those belonging to the Institute, assisted by persons professionally acquainted with the subject of the work, pronounced a final opinion on the merits of the different designs.

It has already been submitted by the Committee that an occasional outlay of public money on British works of art of acknowledged excellence, and in the highest style and purest taste, would be a national advantage. It has also been suggested that, in the completion of great public buildings, the arts of sculpture and painting might be called in for the embellishment of architecture to the advancement of the arts and the refinement of the people. The habitual contemplation of noble works in fresco and in sculpture is worthy of the intelligence of a great and civilised nation.

It will give your Committee the sincerest gratification if the result of their inquiry (in which they have been liberally assisted by the artists of this country) tend in any degree to raise the character of a profession which is said to stand much higher among foreign nations than in our own; to infuse, even remotely, into an industrious and enterprising people, a love of art, and to teach them to respect and venerate the name of "Artist."

August, 1835.

ABSTRACT OF ADDITIONAL EVIDENCE GIVEN BEFORE THE COMMITTEE.*

Dr. Bowring, examined.

My attention has been called to the subject of the connexion of design with manufactures in various countries, as one of the Commercial Commissioners of the British Government, and it has been naturally a primary object to discover in foreign manufactures the causes of superiority. I have examined in more or less detail the manufactures of the whole of central and southern Europe; but with a special view to the inquiries of the Committee, the state of the fabrics of France is the most interesting; for the superiority of France, where it exists, is almost wholly attributable to the application of art and taste to the various raw materials of her manufacture. If the manufacturing exports of France be examined, it will be found that in those departments of industry in which taste can be introduced into manufacture, the superiority of France is remarkable and undoubted. I

* For preceding evidence, see Mech. Mag., Nos. 639 to 643.

will mention an example:—Of the silk manufactures of France, five-sixths of her whole productions are exported; of the silk manufactures of England, probably not more than one-eighth or one-tenth are sent to foreign countries. The reason is found in the superior excellence of French patterns. So in the cotton manufacture, for in those departments of France, Alsace for example, where the arts are most advanced, they are, notwithstanding the higher price of the raw material, notwithstanding the imperfection of their machinery, the absence of sufficient capital and the heavy local taxation, able to export those cotton manufactures which are recommended by beautiful patterns, or are in any way connected with the application of the fine arts to manufactures. It appears to me, that the only way to get over every question of prejudice, and to decide on the real superiority of the manufactures of a country is to go to a third market, to which all countries have access; and if you find in every such market preference is given to certain articles, there can be no doubt that those articles have in themselves an innate and essential superiority. I mention this, because in this country, for a very long period, an idea existed that it was prejudice, a passion for novelties, a blind preference for foreign articles, and not the substantial fact of superiority which created the demand for certain manufactures imported from other countries. The action of a superior French taste has operated directly on the improvement of many articles, and really, even though remotely, upon the whole extent of of our manufactures. Their presence has created a superior school, and has acted upon the English manufactures in the same way that the works of the great masters have acted on the schools of art. The causes of French superiority appear to me to be many and various; probably something is to be attributed to the national character. Their great restlessness and love of change, their *mobilité*, as they term it, constantly creating new objects, and the demand for new objects. I think, too, the circumstances that surround them are very favourable to the study and the love of art; their public collections and museums are every where accessible, and very much visited by the labouring population. Their architecture is very varied, and decidedly progressing. Even the dwellings of the people are not built upon a uniform model. Their churches have in them beautiful paintings, admirable sculpture, fine music; in a word, all the arts are made subservient to religious services. The common beds and furniture of their houses are much more graceful than in this country, and frequently exhibit much tastefulness and variety. The costume of the people in different parts of the country must have struck every observant traveller as presenting, amidst its varied character, such frequent and striking specimens of simple and ornamental dress, as pourtray a widely-extended taste and tact. I think, too, the out-door existence of the people, their more immediate and constant connexion with those specimens of art which exist wherever civilised men are congregated together, has had some influence in the formation of national superiority in this respect. Then, too, it appears to me, that a more immediately and prominently active cause of the artistical character of the French population is to be found in the popular schools of art, which are now not only widely spread, but their field of action and of study is enlarged from day to day. I have visited the schools of art in several departments. The school which I have seen with the most interest, and studied most in detail, and which on the whole I think has been most influential in improving the character of the manufactures, is the school of art at Lyons. I went through that school only a few weeks ago, and was much struck with the great extension that has been given to its influence and its usefulness since I visited the same school some years since. In France, I think there are about eighty recognised schools of art. The origin of all these institutions in France is to be traced to a conviction, that the application of the principles of art and science to manufacture is the best means of improving that manufacture; and there has been a succession of legislative measures, some of them general, some municipal and local, by which these schools of art have been adapted to the wants of peculiar branches of industry. They are generally public, and open and free. There was a time in which it was difficulty to get pupils in some of those departments of study, to which I will afterwards refer. When these schools were first founded, there was little disposition on the part of the labouring classes to avail themselves of their advantages; there was a great deficiency of students, particularly in some of the branches where the inferiority of the French workmen was most generally recognised; for instance, in the schools of ornamental architecture; and generally speaking, thirty, or even twenty years ago, the schools of art languished for want of pupils; but now, in many of the towns where I have made inquiries, there is such a rush of students, that it is impossible to find instruction for all, and this is particularly the case at Lyons. At the present moment there are 200 students in the Lyonese

schools; every class is full, and the candidates for admission are many, far more than can be provided for; in fact, they are filled to overflowing, and the different professors assured me they were quite embarrassed by the number of applicants for admission: Now, till within a few years, the number, I believe, never exceeded 120 to 140. The School of Art of Lyons originated in a decree of Bonaparte, dated, I think, from Warsaw, Its object was to give elementary instruction in art, with a view to the improvement of the silk manufactures of France. But its field of usefulness has widened from time to time, and it is now divided into six principal departments—that of, 1. painting; 2. architecture; 3. ornaments; and *mise en carte* (which is the means of communicating to a fabric or to a manufacture any model or drawing upon paper). There is also, 4. a botanical department; 5. a sculpture department; and, lastly, a department which has been added within the last year or two, that of engraving. The department of painting is divided into three sections; the first is the school of painting, or drawing from the living subject; the second from busts or inanimate nature; and the third is called the class of the principles of painting. That general instruction which exhibits the great principles of art connected with its history and progress. The class of architecture is divided into two departments, the school of composition, and the school of ornament. I mentioned before that this ornamental class had formerly little success; and it appears by the returns, that from 1807 to 1830, there were seldom more than from three to four students. According to the report of the last year, I find that at this moment there is not a class more popular, and that the professors are embarrassed by the overflowing number of candidates. The botanical class is divided into two departments, oil painting and water-colours. A botanical garden is attached to the institution, and perhaps nothing presents more prominently the influence that the great schools of art have had upon the manufactures of France than the general botanical correctness of almost all the patterns which have lately emanated from the Lyonese fabric. The designs are almost invariably made from living plants and flowers. It is impossible almost to give a correct and beautiful representation of the object without that. The class of sculpture has two divisions; that of ordinary sculpture, and ornamental. The class of engraving was lately introduced; and, perhaps, it may interest the Committee to know what are the principal improvements which have taken place in the school during the last three years. A considerable collection of models has been made; a living subject now sits in the school five hours a day. The botanical garden is opened under certain regulations, to the students themselves, for the collection of flowers. A large library has been formed of engravings. They have introduced upon the dead subject a course of what they denominate picturesque anatomy. They have attached to the school a cabinet of natural history, and have lately sent to this and to other countries individuals, who have been charged to collect appropriate specimens; and they have collected, in a cabinet attached to the school, all the works of the students which have obtained prizes, independently of the erection of a very large museum, also connected with the school, which contains specimens of the antique. This museum will be open to the public gratis as soon as it is completed. There is a museum at Lyons open gratuitously to the public. I brought with me from Lyons, as an evidence of the extraordinary progress that their schools of manufacture have made, a work of a professor, which I think will show a superiority in the art of weaving, of which even this country has little idea. This is the work of the Jacquard loom, and affords an example of the *mise en carte* of a very delicate painting, reproduced on silk by the shuttle. I think the Committee will be convinced that nothing comparable to this in beauty and perfection has been yet produced in this country. [*The witness produced the same for the inspection of the Committee.*] I exhibit this to the Committee as a specimen, showing the state of art as taught in the schools, and to give me an opportunity of stating a fact or two as to the changes of opinion which have taken place in Lyons favourable to manufacturing improvement. Jacquard, the inventor of the beautiful and simple machinery by which the most intricate and complicated patterns are produced by the common shuttle, was more than once exposed to assassination, in consequence of the prejudices of the people against his discovery; he was regarded as a public enemy. Three attempts were made upon his life, and he was obliged for years to hide himself from the vengeance of the labouring population. That machine, by which this stuff was wrought, was broken up in the public place by the order and in the presence of the authorities. But Lyons, while resisting all manufacturing improvement, saw her trade decline, and her inhabitants reduced to misery. In the time of her distress Jacquard was again thought of, and the resuscitation of the manufacture of Lyons is solely due to the introduction of the

mechanism which had been thus publicly and ignominiously destroyed. Jacquard not only lived to see himself reinstated in the affections of his fellow-citizens, but was pensioned by the town of Lyons to the extent of 1,000 crowns yearly; he was decorated with the Legion of Honour; he became the pride and boast of the operative classes; and I venture to say, that among the work-people of Lyons there is not at this moment a name held in any thing like the same esteem and affection as the name of Jacquard. He saw this change before he died, for his death took place only last year. He was accompanied to his grave by the most distinguished persons of his neighbourhood, and by multitudes of the working orders, and his picture now occupies the place of honour in the museum of the School of Art. I mention these circumstances as a remarkable instance and evidence of improved opinion, and of the disposition to consider the contributions of art and science as valuable auxiliaries to the manufacturing interests. I attribute their appreciation of the merits of Jacquard to their advancement in the arts. This very town, which treated his discovery with so much injustice, has lately decreed that a monument shall be erected to his memory. At this moment 10,000 Jacquard looms are at work at Lyons. With reference to the beneficial action of the schools, I believe there are not two opinions. In the last report on the state of the schools it is declared that, their influence has been incalculable, and that it has elevated the character of the manufacture in all its departments. The words of the report are:—"If collections of ancient patterns be compared with those which are produced at the present time, the extraordinary distance which separates them will be obvious to every body, and every step will exhibit the progress made in abandoning the mere routine of production, and the beauty and perfection which able artists have thrown upon manufactures. The influence of superior models, the counsels of intelligent professors, and the emulation of zealous students and artisans, will be every where discovered. Already the influence of the school is seen in our streets: our architecture is enriching itself with classical ornaments, and the part which Lyons took and the honours which were done her in the late 'Exposition' at Paris, sufficiently attest that the attentions which have been given to the Schools of Art have had their influence upon the prosperity and reputation of the town and neighbourhood; peace has indeed called the attention of other countries towards our situation. England, Russia, and Switzerland, are our followers; they are endeavouring to move forward with us in the road of our superiority, and perhaps they are not far behind us. But you must make efforts equal to the wants of the epoch, and give more and greater influence and extent to your exertions." I may add here, that I lately visited the Royal School of Design at Paris, where I found that there are no less than 600 students inscribed, of whom 400 are generally present. There too the interest felt and the demand for instruction is greatly increasing, and a number of the students do not exceed the age of nine years, at which they are now admitted to the morning lessons. It is right to mention that the general budget of the State gives assistance to the Schools of Art, and the sum not raised by the State is furnished by the municipal funds. At Paris, the budget of the Minister of the Interior gives 20,000 francs to the Royal School of Design, and the municipality gives 6,000 francs. The course of study lasts for three years, and the students pay five francs for the first year, and ten francs for each of the second and third. It is impossible to say whether it is better for Government to assist or to interfere in these matters. It must be remembered that in France the action of the Government is every where: that there is no branch of the administration which is not directly or indirectly dependent upon the Government itself, and that the influence of the Government of Paris is so intertwined with the local organisation, that it would be scarcely possible for those schools to move as they move, unless the protection of Government were behind them. Every body looks to the Government, and the Government meddles with every thing. The Government authority is supreme, and would be used without hesitation or control in certain cases. The Minister of the Interior has two influences—a direct influence through his own budget; and an indirect influence through the local budget, which is not legal till it is approved by the Minister and the King. The municipal funds in France are devoted to those objects, and to more extensive objects of education in some cases. With reference to Lyons, I should state that, at this moment, a very large educational establishment is in progress, called La Martiniere. A gentleman of the name of Martin died in the East Indies, and left immense wealth to the town of Lyons, directing that it should be applied to the creation and endowment of an establishment for public instruction. It is the intention of the trustees to devote a portion of this establishment specially to the arts and sciences. I ought perhaps to mention that, though so many branches of the fine arts are taught in the Lyonese school, they are all subordinate to the manufacture of silk stuffs, the staple productions of the

town and neighbourhood. There is a school also at Rouen, but neither so extensive nor so complete. There are also colleges in the communes in which instruction is given in the arts. It forms part of the education in the primary schools. Previous examination is the test of the admissibility of the scholars into institutions such as that of Lyons; they must be Frenchmen; they are to be Lyonese in preference to the inhabitants of other parts of France; if they are workmen, they are obliged to produce their *livrets*, and I believe also the evidence of French citizenship. Wherever specimens of art are accessible, and wherever people avail themselves of them, that they must and do produce a taste for art and a love for art. Shilling exhibitions of the works of provincial artists, which are the only ones open in our large towns, are perfectly valueless in their effect upon the public mind; they present to the attention of the people, not superiority, but frequently inferiority, and they must lower the taste, in as far as they have any influence, to the work of the exhibiting artist, instead of elevating the taste to something superior, and which is inaccessible by him. They have two faults: in the first place, may they not mislead the public taste from the genuine principles of art towards mannerism and bad taste? and, secondly, are they not exclusive institutions, inasmuch as they are only open to such as can pay for them? The first object is, that museums should be numerous, should collect every thing that is most beautiful and perfect in art, or copies and models of what is most beautiful and perfect, and when those recognised models are so collected, that the doors should be opened as widely as possible to the public at large. The French Exposition—the triennial exhibition—has in some cases produced some good; but I doubt much whether it has had the extensive influence that sometimes is attributed to it. The great defect of the French Exposition is, that the cost of production is completely lost sight of, and that the articles exhibited there have little reference to a market. In some cases which I inquired into, I found the cost of some beautiful productions was such as completely to destroy any chance of sale. Now it is clear, that any recompense to be obtained by public exposition of an unsaleable article could be but small, whereas if the question of cost entered into the calculation of the exhibitor, and if, when he was exhibiting a piece of work which was attractive in consequence of its intrinsic merit, he could show that it would be cheaper than its rival articles, it would be the best encouragement that could be given to him. But the consideration of cost is almost wholly kept out of sight; and the premiums are given rather with reference to the perfection of the work than to its being saleable, or suited to general demand. It is less the offspring of a demand made by the public than of a stimulus given by the Government. In nine cases out of ten it is rather the triumph of personal vanity than the success of manufacturing superiority. I mention as an instance of national character, that when I was applied to some time ago, by the town of Lyons, to request certain of our manufacturers to send specimens of their fabrics for exposition, they almost all refused me, stating, that they preferred profits to praise. I have lately been in Switzerland, where a great deal of attention is being paid to the schools of art. I have before me the programme of the school of art at Geneva; that school has principally for its object instruction in those branches of art which can be applied to the manufacture of metals, particularly with reference to watchmaking and jewellery. It is under the protection of the Government, and students are admitted at the age of fourteen, after examination. The course of study lasts three years; in the first year they are taught arithmetic, and the drawing of machines, with the use of the rule, the square, the compass, and other mathematical instruments. In the second year, algebra and plane geometry, the manufacture of machinery, the elements of physical and mechanical science. In the third year, trigonometry, statics, solid and spherical geometry, the manufacture of the more complicated machinery, inorganic and organic chemistry, hydrostatics and hydrodynamics. Switzerland is at this moment the seat of the most extensive production of delicate mechanical works. In the Jura mountains, in the French part of the Canton of Berne, and at Geneva, almost all the watches, musical boxes, &c. which supply the Continent of Europe and the Western and Oriental world, are manufactured; and the extent to which the knowledge of the mechanical arts is diffused among that population, whose habits are partly agricultural and partly manufacturing, but altogether domestic, is very striking. I imagine that the average rate of wages for manufacturing labour in those districts is higher than in any part of the European world; and the effect of their great knowledge, industry and aptitude has been such, that more than half the population have become proprietors of land. A man can scarcely be found who is not able to read and write, and who is not a practical master of that mechanical art with which his trade is particularly connected; and yet I found amongst all those watchmakers one of the best evidences of knowledge, namely, a wish to know more, the expression of a great desire that further means should be taken to communicate instruction in yet higher branches

of art and science; and I will mention a fact of the influence of their superiority, even in remote regions—that I found the Jura mountains had been lately visited by a Chinese, who had come all the way from Canton, and had studied there three years among the watchmakers, in order that he might set up trade in China. Such is their superiority, that they carry on a large trade with the remotest regions, and I believe that superiority to be mainly due to the great diffusion among them of the practical science of mechanics. I think there are eight or nine professors in the Ecole Industrielle of Geneva; but there is also a special school of watch-making, for the instruction of those who mean to pursue that particular branch of industry. In the school at Geneva, five francs are paid for the first year, and ten for the second and third, and the deficit is made up by Government funds.

The question of copyright of patterns is one of great importance, for though in some parts of Europe an opinion prevails, that the interst of manufactures are most advanced by want of protection, and a recognition of every body's right to avail himself of the inventions of others, in France, certainly, the opposite opinion is almost universal, and there is a great deal of legislation existing, the object of which is the protection of copyright. The penal code recognises the right of every inventor to the protection of his patterns or other inventions, even though he should not be protected by patent, and provides that a penalty of not less than 100 francs, and not more than 2000, shall be levied on any individual who violates the copyright of another; and it also provides that a fine of not less than 25 francs, nor more than 500 francs, should be levied on any individual who sells a pirated article. I recollect no French term for copyright, but the general term *proprieté* or property. The invasion of that property by the piracy of a patent, mark or pattern, is called a *contrefacon*, or forgery, and the invader in denominated a *contrefaiteur*, or forger. The law also provides for the confiscation of all pirated copyright, whether of patents or otherwise, also all plates, moulds and matrices which have been pirated. Formerly the application of this law was left to the ordinary tribunals, but it was found that that machinery was too cumbrous and expensive, as is the fact at this moment in England; and a local tribunal now exists in most of the manufacturing towns in France, to which all questions of copyright are referred. That tribunal is called the Conseil de Prud'hommes; it is composed of an equal number of manufacturers and workmen, plus one manufacturer, who is president of the tribunal, and this tribunal is charged with the decision of every question of manufacturing interest. The following are the principal trades which are made responsible to the Conseil: manufacturers and operatives in silk, cotton, woollen, hair, flax, hemp; manufacturers and operatives in steel, iron, silver and silver plate, gold, copper and bronze, pins, needles, fire-arms, scales, jewels, buttons, cutlery, tin plate, hardware, wax and tallow; manufacturers and operatives in hosiery, earthenware, glass, paper, starch, white-lead and chemicals, &c.; fullers, dyers, calenderers, carders, enamellers, fan-makers, cork-cutters, perfumery-makers, comb-makers, plumbers, turners, tanners, curriers, boot and shoemakers, coopers, shipwrights, and sail-makers, smiths, printers, instrument-makers, musical string-makers, leather-dressers, tailors, chocolate-makers, and mechanics of all descriptions. Those trades come under the jurisdiction of the Conseil de Prud'hommes. That institution is charged with the settlement of all manufacturing questions. It is really a tribunal of conciliation, against whose decision there is an appeal in certain cases. It has a power of fine and of imprisonment. All questions of the "marks" which any manufacturer chooses to adopt to designate his wares, and all questions of patent and copyright are referred to it. Patents in France are considered as manufacturing property, and are subjected to the conditions of two laws, known by the title of the Patent Laws, and bearing date January and May, 1791. The proprietor of a patent has the power of bringing any one who violates that patent before the ordinary tribunals; and independently of the fine which may be levied, the law requires that a quarter more than the fine shall be given to the poor of the district in which the patent has been invaded, provided the fine does not exceed the sum of 3000 francs. It is necessary to state that a patent has not legal effect until it is inserted in the Bulletin des Lois. The Conseil de Prud'hommes has also jurisdiction in all cases of patents; but it is required, in order that the patentee may have the right of calling upon the Conseil de Prud'hommes, that the patent should be recognised and recorded in the archives of the Conseil, as is the case in matters of pattern. The Conseil de Prud'hommes has jurisdiction over three descriptions of manufacturing property—over patents, over "marks," where "marks" are violated, and over patterns. The Conseil de Prud'hommes being an economical tribunal, the patentee would have recourse to it rather than to the higher and more costly tribunals. Any

patentee may use this minor tribunal if he prefer it. The Conseil de Prud'hommes is a tribunal which decides on the violation of patents of marks and patterns employed or claimed by a given manufacturer. It is at once a legal and an equitable tribunal. Many of the manufacturers of France, as those of hardware and cutlery, are authorised to employ a "mark," and on their registering that "mark" at the Greffe of the council they get an exclusive title to its use; and the person who employs surreptitiously the mark or device of another, is not only responsible for the consequences and the losses, but is considered by the French law as a forger, and subject to the penalties which apply to the forgery of handwriting. A "mark" is deemed a property, if a manufacturer choose to have it so recorded, and can give evidence from the books of the council of his priority of inscription; and the Conseil de Prud'hommes are judges as to whether the imitation of the "mark" is a violation of the property. In case of appeal the tribunals of commerce overrule the decisions of the Conseil de Prud'hommes. With respect to patterns, the law recognises equally, as in the case of patents, the right of property; and the decree of 1826, by which the Conseil de Prud'hommes is established at Lyons, specially invests that tribunal with the preservation of the property of drawings and patterns, and requires that any manufacturer who wishes to obtain security for a pattern shall deposit his pattern under an envelope, with his seal and his signature; and to this packet shall be attached the seal of the Conseil de Prud'hommes; that a register shall be kept of all such inscriptions or claims to copyright, and that the manufacturer applying shall receive from the Conseil a certificate stating the date when he deposited his pattern; that in case of dispute with respect to the copyright of a pattern, the register in the archives of the Conseil shall be taken as sufficient evidence of the priority of date when the pattern is deposited; the manufacturer shall declare for how long he desires the copyright should be possessed by him, whether for one, three or five years, or in perpetuity. It allows a perpetuity; when the period has passed for which the Conseil de Prud'hommes have guaranteed the copyright to him, in the cases where that period is defined, the ordonnance requires that the pattern shall be delivered to the Conservatory of Arts in the town of Lyons, and the patterns shall form a part of the general collection of the Conservatory; and I may mention that this collection of patterns is the most striking history of the progress of manufacture. After a certain time they come to this Conservatory, and in those patterns may be traced all the improvements that have taken place. When the pattern is deposited the manufacturer pays into the hands of the receiver of the Commune a certain sum, which is fixed by the Conseil de Prud'hommes, and which must not exceed one franc per annum, during the period for which he wishes to preserve the copyright of his pattern; ten francs is the payment for a perpetual copyright. These councils are specially charged with the recognition of the copyright of the pattern that any manufacturer shall desire to register; and secondly, they are required to afford him prompt redress if his copyright be invaded. The Conseil de Prud'hommes is the sole judge of the fact of the violation of copyright, and pronounces the sentence against the violator. I wish to mention as a fact, showing not only the activity of this Conseil but its popularity, that in the year 1835, 3835 cases were decided by the Conseil de Prud'hommes at Lyons, of which 3680 were terminated by their intervention, and only 152 appeals were made against their decision, that is to say, one case is 34. These cases comprise all the questions of every sort between manufacturers and operatives; not questions of copyright alone, but of every species of misunderstanding. It is an open tribunal; I have attended their decisions; I have found their decisions generally satisfactory, that their proceedings are much canvassed, that in all cases of interest there is a great attendance on the part both of manufacturers and workmen, and that I am disposed to believe no better organisation has been yet discovered for the application of a fit and economical remedy to such cases as the council is ordinarily called on to decide. The number that composes the tribunal is various; I think that there are some Conseils in which the number is not more than nine, and I believe that in others there are as many as twenty-five. There is not a different tribunal made for each trade; but in case of any difficulty the tribunal has authority to nominate experts, individuals who are well informed on the particular subject of inquiry. They examine and report to the tribunal. For example, manufacturers and workmen connected with a special manufactory would be called in in cases where that manufactory was the subject of contestation. A portion of the tribunal is submitted to annual election; the manufacturing portion is elected by all the manufacturers who pay for *patentes*, which are in France a manufacturing or trading license. The workmen at Lyons are elected among those who possess a certain number of looms. In the organisation of these tribunals a great deal depends upon local circumstances, and the importance of particular trades. In towns where there are

various manufacturers, a provision is made by the organic statute that there shall be in the tribunal so many individuals representing a particular trade. In the town, for instance, of St. Etienne, where there is a large manufacture of silk ribbons, and also a large manufacture of arms, hardware, and cutlery, it is provided that there shall be in the Conseil a certain number of silk manufacturers and a certain number of hardware manufacturers; so in any town where the manufacture is one of cotton, there the ordonnance provides that there shall be a certain number of persons connected with this particular manufacture. At Rouen, for example, the council is composed of fifteen persons; five to be chosen among the manufacturers of cottons, linens, or silks; two among spinners or machine-makers; two among manufacturers of woollens; two among dyers, bleachers, finishers, chemists, refiners of sulphur or other similar articles; two among printers of cottons or paper; one among earthenware, pottery, tile or brick manufacturers, or metal founders; and one among soap-makers, tanners, or candle manufacturers. This decree of organisation issues from the minister of the interior; the law allows the King to organise the Conseils de Prud'hommes, according to the circumstances of the case; and on a representation of the Chamber of Commerce, either of the town or district, the towns in which these Conseils exist are obliged to furnish a court for their sittings; that their sittings generally take place in the evening after the labours of the day. The fee for a certificate of registration of patterns is three francs; and the fee for summoning any party to the tribunal is one franc and 25 cents. The fee is two francs for the announcement of a judgment, and the tribunal grants to any witness the amount of one day's labour. The costs of any process are of course paid by the parties losing the cause. Supposing that of silk manufacture is proceeding in Lyons and also in another part of the country, and that an individual in one of the two places takes out a privilege for a pattern which has been taken out in the other seat of the same manufacture, I imagine that the right would then depend upon priority, and that the earlier date, wherever recorded, would decide the question. The appeal is to the superior tribunal of commerce. The above is a case that has seldom occurred in those towns from this circumstance, that almost all the manufactures of a peculiar kind are bounded to a certain district. But I can easily conceive that there would be great difficulty here, where manufacture is spread over a wide extent, and in districts far removed from each other.

Mr. Thomas Jones Howell, examined.

I am one of the inspectors for administering the Factory Regulation Act. My district is a very large one, but the places in that district to which this inquiry is applicable, I apprehend to be Worcester, Birmingham, Coventry, and also Wolverhampton and Kidderminster; the three first are the places to which I shall be able to give information. With a view of furthering the objects of this Committee, I went to Birmingham, Coventry, Worcester and other places during the recess. I endeavoured to get such information as I thought would be useful to the Committee. There exists generally a strong desire on the part of the operatives for any means of instruction and information which they can possibly obtain; and an opinion that the existing means for supplying those wants are not adequate. This opinion was not quite so strong on the part of the masters, as on that of the artisans themselves. Worcester has a society, called "The Literary and Scientific Institution," where instruction in drawing is afforded to the members; and, as I was informed, certain persons connected with the porcelain works attended there. A very short time before I was at Worcester, Mr. Constable, the Royal Academician, was brought down by this institution for the purpose of lecturing on the fine arts; and, on going over the works both of Messrs. Chamberlain and of Messrs. Flight and Barr, I conversed with several of the operatives who actually had attended those lectures. It had been intimated to me, that probably those men had done nothing but pass a pleasant evening, and being out of mischief by attending that lecture; I, however, asked some of the men themselves, "Did you attend at Mr. Constable's lectures, and do you think they were of any advantage to you?" the answer was, "That they had attended the lectures with great profit to themselves, as tending to correct their taste and improve their judgment;" those were the words of one operative, and adopted by the rest; he appeared an extremely intelligent person. At Worcester they are extremely desirous to have a collection of casts; at present their principal instruction is derived from the senior operatives in the porcelain establishments, and such additional means as they can obtain from private drawing-masters in the town. At Worcester also I learnt from the operatives, that they conceived themselves to have derived considerable advantage from the exhibition of pictures in the town, particularly one of the ancient masters, furnished from the private collections of gentlemen in the neighbourhood.

It was mentioned that it was not in the power of the manufacturer to produce new designs at a cheap rate. I will give the

expression of one gentleman on that subject:—"In the present day every one is desirous of cheap things, which desire tends materially to discourage the art of design in this country, as it is not in the power of the manufacturers to produce new designs at a cheap rate." If they could get a higher class of art more cheaply than they can at present, that objection would be in a great degree removed. The great risk of the China trade in particular, which is so great that cheapness is not to be obtained; that is with reference more especially to those things which are done by the pencil and not by print. If a plate is destroyed that has been painted elaborately with shells and feathers, and so on, you then destroy the whole thing. It follows as a necessary consequence, that the less consequent on this occasional risk would be diminished, if the works of art being more cheaply performed, and the manufacturer was able to replace the design at the cheaper rate. It is highly important, even in this higher branch of the china trade, that the co-operation of art with the manufacturers should be introduced as cheaply as possible, and more especially with reference to Worcester, where they are abandoning the printing and devoting themselves chiefly to painting. They have no galleries open, nor exhibition, except the casual exhibition to which I have spoken. The want of such exhibitions of casts and works of acknowledged merit in ancient art is felt, particularly by the operatives. I think they paint flowers on China from nature. They were certainly painting feathers from nature, for I saw them; and I believe they paint flowers too from nature. Time would be found by the operatives, if means were given for these studies, because they actually do attend at that literary institution, and they found time to attend Mr. Constable's lecture. There is an impression that the manufacture at Worcester is improving; I saw a very beautiful service making for the Pacha of Egypt. The number of persons who are concerned in the modelling, if one may use the term, is much smaller than in painting, and I do not believe they have above one in each establishment. They appear to be aware of the importance of simplicity and elegance of shape, such as we see in the remains of Grecian art. At Birmingham the same desire to be instructed in art was evinced, among operatives, more especially the modellers and dye-skinners, and engravers, to all of whom proficiency in art is of the very highest importance, and of which they are most deeply sensible. At one of the large lamp and chandelier manufactories, I had a long conversation with a modeller. The Committee are aware that the design having been selected or drawn, the business of the modeller is to make in wax the design which has been given to him on paper, altering it, if necessary, so as to make it look well, and answer well in substance; for frequently a beautiful drawing will make a heavy and ill-proportioned article when presented in substance. Again, it frequently happens that the design cannot be formed in substance without alteration, from want of necessary support and solidity to the fabric, which would result from a close adherence to the drawing. This man, to whom I have referred, had been and was attending the drawing lessons of the Society of Arts (which exists in that town), and at leisure times was frequently in the habit of modelling for his own improvement. He considered that he had derived benefit from his attendance at the Society of Arts; but said that much more might be done if prizes were given for the best models and drawings; and he spoke of the great benefit which would result from a public institution of this kind, more enlarged in its views, and fostered by Government: that now, to receive any benefit, a pupil must annually pay a guinea subscription. This Committee, I believe, have a return from that society, which was founded by Sir Robert Lawley, the late Lord Wenlock, who presented a collection of casts of approved specimens of ancient sculpture to it. At the time of my visit to Birmingham, these casts were displaced to make way for an exhibition of pictures by modern artists. These casts were not accessible to the public gratuitously. The charge was a guinea a year. One of the operatives told me, "if Government will provide a public and free institution, I will undertake you shall have 500 pupils next week;" and at the time I was there, a great part of Lord Wenlock's collection I could not see, because they were stowed away in cupboards to make way for the exhibition of modern pictures, which a person capable of judging the value of these exhibitions as instructing the manufacturing population in art, said was of no value at all. He in fact mentioned, that on the establishment of the society, that he had agreed to subscribe to it, and to subscribe largely to it, conceiving that the funds were to be applied to the purchase of casts from the most celebrated statues of antiquity and *chefs d'œuvre* of modern artists, and providing masters who should give the requisite hints and instructions in drawing from these, and offering prizes for the best works of the pupils of the society. He stated he was convinced a greater advantage would be derived from drawing over and over again from one statue of undoubted excellence, as the Apollo or the Venus, than from copying and studying any number of modern pictures, to the exhibition of which, in fact,

this society seems now to be chiefly devoted. The sum is, I believe, a shilling for the admission. Generally speaking, the opinion prevailed that the exhibition of these works of modern artists had not been beneficial in diffusing a love for higher art; and that in fact it had no influence on the manufactures of the town. An intelligent workman engaged in chasing, strongly insisted on the advantage to be derived from the study of casts from sculpture, as being far more important than any drawings from modern pictures. He was very desirous that a School of Art should be established on a liberal scale, where opportunity should be afforded to the young artists for drawing from the antique, under the direction of suitable masters, and that prizes should be offered for the most proficient. At the Society of Arts, the annual subscription of a guinea is necessary to entitle any one to draw or model from the casts, which, during the season of the exhibition of modern pictures, are removed into closets, &c.; nor did it appear from his account the instruction given was much, or the attendance of pupils numerous. A subscriber of two guineas annually might recommend a stranger to study from the casts, so that a master thus subscribing may in this way give a premium for good conduct or skill displayed by any one of his workpeople. Workmen more generally take lessons from drawing-masters in the town, than avail themselves of the Society of Arts. I conversed with one of the drawing-masters, who I understood had the largest class. He said he had turned his attention particularly to that branch of art which would tend to the improvement of the manufactures of the town, and had for a length of time had classes of young men who were brought up with a view to these manufactures, chiefly for the die-sinking and the engraving business: some few for the modelling department. He objected to the system carried on at the Society of Arts as too exclusive, and as too much of a monopoly. He had even drawn up a paper containing amendments which he wished to press on the Committee of the Society of Arts. He had been desirous to use the collection of casts at the ociety for his pupils to draw from; but the restrictions and regulations were such as to prevent him carrying his pupils there, and he had therefose obtained a collection of casts for himself. He stated the admission to the society was not thrown sufficiently open, and even to the pupils admitted, the Committee did not give sufficient encouragement by prizes, &c. I do not think there exists at Birmingham, for the instruction of die-sinkers, any of the finer specimens of models; any antique models, as those of Simon at the time of the Commonwealth. The establishment of one would be very advisable, embodying all these objects, statues, casts of vases, candelabras, urns, and coins, which should be entirely open to the public, and gratuitously. I have been over the manufactory of japan work by Jennings and Company; the designs are of a peculiar description; and they were extremely anxious for any institution that the State might furnish that would encourage art in Birmingham, with reference to their own particular manufacture. They have a system in the manufactory itself for instructing the operatives; and that is the chief instruction they get, aided by such private tuition from the professional masters in the town as they are able to spare money for. It is, in fact, a school of itself. They bring them up to it from the youngest age. I think, that any art which is learnt there, is rather learnt in the manufactories than in any existing school of art. The origin of the fancy trade in Birmingham may be traceable to some French artists introduced into England by the late Mr. Bolton, of Soho, when he commenced the great plating concern there: that he could not find in England designers and modellers for his purpose, and therefore resorted to France. I state this on the best authority, both of master and workmen; and indeed it was mentioned to me, that no skilful artist in Birmingham in these departments existed, the history of whose proficiency was not traceable up to those Frenchmen. The Committee are probably aware that Flaxman, the sculptor, and Mr. Wyon, of the Mint, and others distinguished in art, emanated from the school at Soho. It was mentioned to me, in illustration of the dependence of Birmingham, not on its own resources, but on external aid, that when designs of the highest order are required, resort is had to Mr. Bridgen, the designer, of London. There are professional designers in Birmingham; what I have just stated refers to the occasions when they require designs of a very high order. As far as I observed as to glass-cutting, they seemed to have had some original design from which all their new patterns are formed by introducing slight variations. In Coventry I found a similar want, and similar desire of instruction; and perhaps I should say with reference to the desire for additional means of instruction, that it existed in a more extended degree—more especially so far as relates to the conviction on the part of the masters of the necessity of it. It appeared to me the opening of the silk trade has compelled the manufacturers of Coventry to pay more attention both to the design and the execution of their ribbons, and has consequently made them extremely sensible of the advantage of superiority in design. They have recently established two societies there, in which drawing is taught to

the operatives, and they seem to lay very great stress on the teaching of what is called draft drawing (*mise en carte*), both at the Mechanics' Institution and at the Society for Promoting Religious and Useful Knowledge there; they are desirous of obtaining a competent person to instruct in draft-drawing, and they had thought of obtaining a competent instructor from Lyons, who, they imagined, they might get for 60*l.* per annum. I believe there are no French designers there. About the time the fashions appear, or rather before they actually appear in the world, the manufacturers go up to London, and obtain patterns of the different prints which are on the eve of being produced, and make ribbons to suit them. They have no designer there; they obtain them from professional designers, who travel about the country, and who supply not only Coventry, but Manchester and other places. They have no institutions in Coventry accessible to the population, which enable them to observe beautiful outlines of form or combinations of colours; there are two institutions in which instruction in drawing is given. I believe there is no public exhibition; they are more desirous of having such at Coventry than at either of the other places I have visited; the masters there seem more desirous for it, and this I apprehend to be in consequence of their being more pressed by France since the opening of the silk trade. The masters acknowledged that the superior patterns of France had been beneficial to the manufactures of England, as the foreign competition has tended to make them improve themselves. I do not know that the manufactures of Coventry would be particularly benefited by an opportunity of seeing flowers in their natural state; they rely very much on fashion; the manufacturer is obliged to arrange the colour of his ribbon so as to meet the caprice of fashion, which it is said frequently mars the effect of the design, by giving to the leaf and the petals of the flower colours different from those assigned to it by nature. If incongruities of that sort were avoided, it would be very desirable. The manufacturers were very generally discontented with the present state of the law respecting copyright, and they are particularly anxious for some protection. They all complain of the mischief resulting from want of protection as discouraging inventions or costly improvements of any sort—that their original designs are pirated; and more particularly in reference to those productions which can be multiplied by machinery, as it were, such as printing, or things that can be multiplied by the mould. Not so much, therefore, with reference to the painting of a picture on China. I went also to Kidderminster, but there was a great reluctance to give the information. I believe they resort entirely to London for their designs. The Kidderminster people do not make the Turkey carpets. From what I can discover, they are totally dependent on London for their patterns; but they have nothing in the shape of instruction in art there at all. The masters are not capable of producing designs themselves. I went to one of the largest houses there. The gentleman said, "We can read a little and we can write a little. We can manage our own business, and I beg to decline giving you any further information." At Wolverhampton they have the japan-work, but they have no school of art.

Mr. John Millward, examined.

I am a lace-manufacturer at Olney, Bucks; I employ myself occasionally in pattern-drawing for improvements in my own business; previously I was a pattern drawer for the trade generally, and was early instructed in the art by my father, who had spent a half century in lace-dealing and pattern-drawing. The French patterns pleased the general taste so much, that I dared at last to have a style of my own formed on the French mode, and that style has prevailed, in the best laces, to the present time. In the district with which I am particularly acquainted, the peculiar difficulty in conducting the lace trade, appears to be in the circumstance of the work not being done on the premises of the manufacturer, but at the homes of the families employed. The manufacturer appoints a day when his "workers," as they are called, meet him at an inn, and he buys the lace, and perhaps gives them new patterns and parchments to work on, and sees no more of them until the next journey, which may be a month or six weeks afterwards. The purchaser of lace always provides the patterns which are to be worked by the labourer; labouring lace-manufacturers never invent a pattern. I do not think they are at all capable of producing patterns, or likely to be so, they are so completely ignorant of every thing like invention. I never knew them invent one in my life. The copyright of patterns is generally invaded in this way—a number of persons of both sexes going about the country, from house to house, collecting any thing they can buy; searching for every new pattern they can lay their hands on, which they will buy if they can. Any thing which they deem unsaleable, they leave for the regular manufacturer. They buy the lace, which serves them for a pattern. About July last I bought four or five patterns of a young man. The parchments were pricked and drawn very nicely. I gave them out at Stony Stratford, and, with the exception of one piece of lace off one of the parchments, I lost the whole of the patterns, parchments, and lace-makers. There was another case

somewhat to the point. The other day, at Easton Mandit, in Northamptonshire, a woman brought me a bit of lace—I did not know but that she had been all the time working for me—I took it. She wanted a new pattern. Some person reminded me that she had not been there for a twelvemonth before, and that when she wanted a new pattern, she came to me again, to get one to hawk about, and sell where she pleased. There was another case which occurred last Friday at Bromham, near Bedford. A woman brought a piece of blonde to me, which was not mine, and I declined buying it. As an inducement, she told me it was a new pattern; that there had only been one bit of it sold. I did not purchase it. These people, in fact, make a trade of selling new patterns which are given out to them. There was a petition sent to her Majesty about five years ago, in which the petitioners stated that if her Majesty would patronise the lace trade, we should all do well again; and in contradiction to that, I wrote four long letters in our county paper, exposing this piratical system, and proposing to the trade an Act for the protection of patterns. That was at a time when the public mind seemed somewhat disturbed, and I gave it up for a while. My plan was this, that there should be a Register-office at Somerset House, where every pattern should be drawn on a stamp; there should be a pattern worked in lace sealed on, to correspond with it; and that any person working that pattern within a certain time should be fined; any lace-man who should give it out, should pay a heavier fine; and if any pattern-maker should sell the same pattern to two manufacturers, that he should be fined. Our process is so slow, we should require two or three years' protection at least; for a pattern does not get fully into work in less time than a twelvemonth with us. The second or third year is frequently the best year for the pattern that does sell, even if it is pirated. Some measures were taken a few years ago to obtain from France the introduction of patterns into this country. There was a hand-bill sent to our house on the importation of foreign patterns, headed "Encouragement to Manufacturers.—By special authority of the Royal Treasurer of his Majesty King George the Third, dated Whitehall, February 16th, 1819, H. Mather and Son were authorised to import, *duty free*, Patterns and Models of every description of Foreign Productions that may be necessary for the Improvement of the British Manufactures." The state of the art of drawing in the lace trade at present is despicable—contemptible. The drawing is vulgar, and scarcely worthy the name of drawing, in ninety-nine cases out of a hundred. The importation from France latterly has been in blondes chiefly, and some of their patterns are very beautiful, but a great number of them are mean, worthless, and do them no credit for drawing. The number of persons engaged in lace-making was stated, in the petition to her Majesty, as 150,000; and for the supply of patterns for these 150,000, there are only two artists employed at this moment that I know of. I do sometimes draw a pattern for my own use, and so does another person or two. I should define a pattern, in order to give protection to it, by taking the common sense of the trade upon it—what the trade generally understood by it—the manufacturers and lace-makers together. It has nothing to do with the material, the colour, the ground, nor with the filling up; but the outline of the principal flower is with us deemed the pattern. If there is a sprig or a leaf added or taken away, they always say it is the same pattern, only there is a leaf added to it, &c.—the same pattern in point that was in Mechlin; the same worked in silk that was in cotton. So that neither the ground, the material, nor the filling up has any thing to do with it. Supposing that local tribunals could be established for the purpose of protecting copyright, I should propose Aylesbury, Buckingham, Newport Pagnel, Northampton, and Bedford. In my opinion the trade would be improved if better patterns were invented, and if those better patterns could obtain the protection of the law; and at the same time it should be borne in mind, that the lace is worthless, and has no meaning, only as it has a figure or design, or a flower in it. A shawl or ribbon is of service in dress; but the whole value of the lace depends on the pattern, and that pattern is in the trade valueless, because, though purchased with money, it is not deemed property.

Mr. Henry Sass, examined.

I do not think the attention paid to that which I consider the theory or principle of art has been sufficient in this country. Drawing is taught without any reference to principle, and I have had experience of that; I can illustrate in certain instances the necessity of knowing the principle of perspective in trade, for upholsterers, for bookbinding, &c., and I will illustrate that: I wanted some cases made to contain my sketches, which I call my "Hours of Idleness," and I wanted them in the shape of a large book, inscribed as "Sketches." I went to a bookbinder's. I said, "I want a case made very peculiarly, so that language cannot explain it to you; do you understand drawing?" This was spoken to the foreman of Messrs. Leighton, in Coldbath-fields; he said, "Yes." "Then I have no more to say." I then took a sheet of paper, and drew the geometrical figures;

then I drew the perspective views of this book or box, open and shut, and he was perfectly satisfied, and no further conversation took place; and when Mr. Leighton called on me to get paid, I said I am delighted with the result, and you must be a fortunate man to have so talented a foreman, and who so well understands drawing, which is a language of itself; for I only made drawings for that which was a very difficult thing, and I could not explain by language, and he has finished it in a manner beyond my expectation. I have had pupils, from the artisan to the noble, all desirous of learning the art of design in its most simple and specific meaning, to be able to delineate what they see. Upholsterers have sent their sons to me, to be educated in perspective, in order to give designs for furniture, bedsteads, drawers; and so successful has been the application, that a succession of them have come purposely to learn that. The productions of the upholsterer are very much improved; persons are becoming so enlightened, and feel the necessity of learning the art of design as a language of itself, by which you really can convey your ideas without speech, that it is getting very general to instruct them in the elements of drawing, as distinct from the common mode of teaching, by putting things before them, without giving them any theory to act upon. The same improvement has taken place in our China trade. I have a remarkable anecdote to relate. I was educated with all the talented artists of the day, at the Royal Academy, and I had among them a fellow-student named Baxter; he not succeeding in the higher departments of art, went down to Worcester, and he painted exquisitely on China. I mention this to show there are artists, if they are cultivated in this country, who are equal to any who are educated in any civilised country. Mr. Baxter, on some occasion, not being very well off, was advised to apply to a great patron of art at that day; he was introduced to him, and submitted to him that there was a great decrease of business in designing. That gentleman's answer was, "Why, I have all my vases beautifully painted from France, and I do not find any equal to the French. I will show you that nothing can be more beautiful than what the French do;" and he brought from his cases some of these vases. Baxter was delighted to see them, and he said, "They are my doing; but they have got the French mark on them, because they could not sell them in this country without their undergoing that transformation, as it were."* I would engage to teach any person possessing intelligence the simple principle of design. I attended the Court of Common Pleas one day when they were trying an action which was brought by one individual against another for the bad packing of goods on board a ship; and the witness had puzzled the jury and the judge for two hours, endeavouring to explain that they were badly packed: the counsel for the defendant said, "Well, I do not know whether I have forgotten my drawing, but I think I can describe by a simple diagram the manner in which these things were packed." He did so; it was handed to the witness; the witness acknowledged that that was right which he had been endeavouring to prove was wrong; it was handed up to the jury, and the case was decided in favour of the defendant. Perceptive powers are awakened by the opportunity of seeing those things which should be seen by persons among whom art is to be encouraged. If museums and galleries were thrown open to the public, the advance of intellectual improvement would be great; France and Italy give a very good example of that—because there every place where there is any art is thrown open to the public. My opinion is, that every town should have its museum, but at the same time something systematic should be encouraged in teaching persons how to see with their own eyes; and then to have a collection of those archetypes of art which have passed through the approbation of ages—the Greek statues, as a foundation of pure and elegant taste. I would have these exhibitions open to the public at all times gratuitously—the whole body of people admitted. There is an old Latin quotation—

> "Ingenuas didicisse fideliter artes,
> Emollit mores, nec sinit esse feros:"

which has been translated,

> "These polish'd arts which humanise mankind,
> Soften the manners and refine the mind."

In the grand days of Athens, when presided over by Pericles, Phidias, and a host of talented men, the works of art were exhibited to the public view before they were put up in their places. With reference to the Elgin marbles, I should say that such is the beauty of them, that they are not seen to advantage in the building that Government has ordered to be constructed for them—light and shadow is a most essential thing. We have but one light in the world, and if you have two lights you destroy the effect. The first thing to be thought of in representation is form, then substance; and on a plain surface you draw the outline the moment you put in the shade, and that single breadth of light and breadth of shade stands out as a substance; then you have only to embellish by colour, and the thing is finished; it only depends on those three things. In speaking of light and shade, much should be done so as to have a central light to light any thing that is valuable. I

* See evidence of Ed. M. M. vol. xxiv. p. 186.

may allude here to the most perfect light I ever saw, the Pantheon at Rome. It is recorded that the ladies, when they wished to see their lovers, walk round the Pantheon; there the light is in an angle of 45°, and every person and every thing looks more beautiful in an angle of 45° than in any other light; it is just the medium between the two, one and 90.

Mr. Robert T. Stothard, examined.

I am a draftsman and an artist, son of the late Mr. Stothard, the celebrated artist. I am led to believe that there is an omission in the application of art to the minds generally of persons of all classes, from the prince to the mechanic; and I believe that, to have any effect in participating in the formation of mind, it must be rendered early applicable and simple to his understanding. I am led to come to this conclusion, from the circumstance of drawing-masters undertaking to instruct, more as a means of their own support, than spreading it as a general chastener to the community at large. In a manufactory which I attended some years back with my father, when he was engaged upon the shield of Wellington, in superintending the chasers at Camberwell; many parts of that shield that the men had been at work upon, at a very high salary, were obliged to be sacrificed, and fresh silver soldered on, and the work to be done over again. This is one instance of the art not being properly applied to the mechanic. To render the art efficacious in the formation of the mind, it must be applied early, otherwise it will never act upon the mind, so as to give it any effect, but as an accomplishment alone. When the artist has furnished a superior design, there is a difficulty in finding a workman to reproduce it in the material on which he is employed. Some of the men employed on the shield had a guinea a day; in extenuation of the fault above referred to, which caused my father to say the work must be cut off, and new silver soldered on, for the purpose of reproducing the effect to his satisfaction, the observation was made, "We do nothing in this country better than tea-pots." I think that exhibitions ought to be thrown open gratuitously, and that an institution be formed for the express purpose of occupying the idle hour of the mechanic, rather than allowing him to spend his time, as he does at the present time, in the pot-house. Art is too dear to make it an element of manufacture. I, a short time back, was at Kidderminster, there was a person there who stands very high as a manufacturer; I had some conversation with him on the subject, and he said it would be desirable to have designs cheaper; that he was obliged to give 5*l.* for a design for a pattern for a carpet. There was a person of the name of Baxter, who was a Student at the Royal Academy for many years, whose works are known from the antique; he could not support himself as he wished, and therefore accepted an offer which was made him from a manufacturer at Worcester, and submitted to that ever after until he died. He became a draftsman to the establishment, and he has drawn the finest things there. I attribute the small supply of artists who are occupied in such works as manufacturers are interested in, to the indiscriminate patronage of persons who have not talent to reach above mediocrity, depending on that patronage which encourages them to take a higher standing in the profession than they are entitled to, but who, I think, if the education was improved in all classes, the patronage would not extend so promiscuously to those who were deficient in possessing that ability, and a division would be made between the artist who had ability above mediocrity, and the artist who never reached that line. By patronage, I mean patronage in the higher circles. There is a decided deficiency of taste in those from whom the demand must come; from the purchaser. I think that among the public generally, there is no proper appreciation of the value of a work of art, and I attribute this to the exclusion of it early from the minds of the aristocracy, in forming their education in public schools and universities. The less opulent, to whom the manufacturers must look for a great demand, seem to be anxious upon the subject, but they see nothing but art in its excellence in public exhibitions, which is too much for their minds to grasp at first; I attribute that also to want of early education. I think their exists among the labouring manufacturing population, a stronger feeling of the want of improvement in art, than among the manufacturers themselves. I have turned my attention to the formation of a general system of education in art for mechanics. It appears to me that if drawings were given to the mechanic, he would have something more than he has at the present time to improve in his after hours, so as to render himself of more service to his master; to meet this, it has appeared to me that there ought to be an institution solely for the purpose of instructing artisans in those principles of drawing which would enable them to avail themselves of their separate branches of business, in order to render themselves, by extra exertion in ingenuity, to obtain an increase of wages per week, in proportion to their increasing families. The institution might be opened at certain hours for their children, for I have heard that, in France, the workmen, in walking of an evening through the fields with their

children, have amused themselves in gathering flowers and arranging them in such groups, contrasting colours according to their law, so as to enable their parent to work them into the loom from nature. I certainly think that not only our manufacturing artists, but the nation generally, is deficient in the true principles of drawing, and therefore not sufficiently able either to create or understand works of art so highly as it might by education be enabled to create and understand. In the first instance, drawing is taught upon erroneous principles, art being applied in an ideal instead of a useful form. For instance, landscape, which is ideal art, is taught before the mind is correctly imbued with the first principles of outline, light and shadow; and colour, which should be studied from individual objects before drawing, is carried into the more complicated branch of art.

Mr. James Nasmyth, Manufacturing Engineer, of Manchester, examined.

I have turned my attention to the application of the arts to manufactures, chiefly with regard to the application in the designing of the framework of machinery, and likewise of buildings employed for manufacturing purposes. In the first place, with regard to machinery, I would show the means of combining the most beautiful forms and the most scientific application of the materials employed in the formation of machinery with the greatest economy. In the majority of instances, the most economical disposition of the materials coincides with such a form as presents the most elegant appearance to the eye; this is especially the case where the elliptic or parabolic curves are employed in the form of the parts which connect one part of the machine with the other, so that when viewed as one design it shall present a perfectly graceful form, and at the same time completely attain the object in view. The knowledge of its application is only to be acquired by instruction communicated to the mechanic in the arts of design in connexion with mechanical science. The framework of machinery I think most susceptible of improvement in design. In every machine there are two distinct parts; the one consisting of the framework, which binds together the details of the machine; the other consisting of the details themselves. It is in regard to the framework that the improvement in the art of design would be most applicable, not only in giving elegance of form, but in attaining a very decided economy in the use of the material. In the case of iron beams and columns being employed for architectural purposes, as a substitute for wood and stone, a system which is now becoming almost general in its adoption, I have known a saving of about a third to be effected by an improvement of form—by a change in the disposition of the material, which in the majority of instances is reconcileable with increased elegance of appearance. With respect to the framework of machinery, being engaged in the manufacture of machines for planing iron, I have found that by the adoption of the parabolic curve in one part of the machine, which has to resist the entire force employed, a saving of at least one-third of the materials was effected, and a much more elegant form given to the design. A certain proportion of mathematical knowledge would be requisite, in order to the correct application of those beautiful forms to practical machinery; but this knowledge is obtained in a natural manner by the mechanic, while engaged im his daily occupation. I refer chiefly to mechanics connected with machinery, all of whose daily occupations are more or less intimately connected with mathematical science called geometry. I may just make a remark; I have always found, from my own experience, that mechanics engaged in these matters possess a very considerable portion of geometrical knowledge, without any tuition at all; it is a common-sense mathematics they pick up themselves, so that mechanics who have never studied it as a science are found quite fit to receive ideas of the most refined kind, because their daily occupation bears so closely on the most abstruse points; they are in a manner just brought up to that point, that a little further information on the subject would give a very material impulse, both as regards the elegance of the design and the prosecution of science itself. I have all my life been in companionable contact with the working mechanic, and being moreover the son of an artist of some celebrity, I have, in the union of those two advantages, been enabled to see the intimate connexion that exists between the arts of design and practical mechanics, the result of which has impressed me with a feeling, that all that is now wanted to bring about the most happy connexion between the two in the person of the working mechanic, is to give him those facilities in improving his taste in the arts of designing, which will immediately produce an influence on the objects in which he is daily engaged. I would have—besides giving every facility for the extension of mechanics' institutions, which refer to the facilities for the study of the before-mentioned subjects in the after-hours of the mechanic—I would encourage, by every possible means, the exhibition of such tasteful works of art, either of modern or ancient design, in some part of the manufactory in which men were daily engaged, that while, in the small portion of leisure time after their meals, they might, instead of loitering about the shop, waiting

for the recommencement of the hour of labour, engage their attention usefully in considering and discussing the merits of such objects, selected from ancient and modern examples, as would materially tend to increase their taste. I would place before them such a selection from the works of the ancients as exhibits, in the most perfect manner, the entire reconcileability of elegance of form with bare utility, as exemplified in the numerous instances, from the most refined works of antique designing, down to the most common domestic utensils or implements, copies of which could be obtained at a very low rate, so as to make them become as familiar to the eyes of the mechanic as the walls of the building itself. I would say, in order that the master mechanic, supposing his mind has arrived at a great state of cultivation, as regards a taste for the fine arts, in reference to its application to manufacturing purposes, requires, in order to bring forward those acquirements into actual existence, to employ agents, those agents are his workmen; and if there exists, at there does at present, too great a disparity between the taste of the master and that of the man, there is such a difference between the ideas of the two, that in many cases the forms which he wishes his workmen to adopt are not those produced by the workman, which leads to a very serious inconvenience and frequent disappointment, occasioning in any attempt at introducing elegance of form, a very great loss of time to the master in giving necessary instructions to his men. In the majority of cases, the most elegant forms of the Etruscan urns can be shown to be derived from the employment of the geometric figure called the ellipsis, placed in different directions; in which case it is shown that, by the study of one simple geometrical form, we are enabled to produce an infinity of elegant forms; and it is to impress such effects on the minds of mechanics that I would recommend the exhibition in the most familiar manner to their eyes, of those remains of antique design which combine in themselves the before-mentioned principles. I think that greater correctness and beauty in the exterior of public buildings would have an improving effect on the mind of a mechanic; and a very decided improvement in the taste of those cities would be the consequence, as it is not from the single exhibition of the works of elegant design that taste is so much cultivated, as those larger and more common objects which are seen in manufacturing towns, namely, the chimneys and other conspicuous parts of manufacturing buildings. In manufactories or chimneys, there are many instances already in the town of Manchester, in which it is shown in the same expenditure of materials, and consequently expense, very different results are produced as concerns elegance of appearance; and I may say, that in the majority of cases with the same expense, forms might be presented which, while they attain the objects for which a building was erected, would present at the same time an appearance not only improving to the public taste, but to that of the town at large. I may say forms are now introducing with respect to steam-engine chimneys in the town of Manchester, which, when contrasted with the forms previously employed for the same purpose, clearly exhibit the growing improvement in public taste with regard to these subjects; and from my own experience, a latent taste exists, which only requires to be excited to make our manufacturing towns, instead of being a reproach to the taste of the country, at once the seat of the most elegant architectural designs and manufacturing industry. There seems to be a want of some system by which these modes of design can be properly systematised and impressed on the minds of the proprietors as well as the mechanics concerned in the above works, and it is only by such improvement of public taste that the wished-for results can be obtained.

Thomas Leverton Donaldson, Esq., Honorary Secretary to the Institute of British Architects, examined.

I have found a deficiency in this country of able workmen, artificers, and superintendents or clerks of the works; and I conceive that no high works of art of the first class can be well executed, however well they may be designed, unless we have competent workmen to carry them into effect. Taking my own profession as the principal point on which I can offer any explanation, I should say that there is not a class of workmen but requires instruction in drawing; that is the basis; both drawing with the freedom of hand, and likewise artificial or scientific drawing. Drawing presupposes a collection of examples which should be very choice, and I do not consider it is necessary for them to be very numerous; such a collection induces a knowledge of good art, and affords the opportunity of drawing and modelling from them. Perspective of course is necessary, because that is nature reduced to rules; Nature herself is subject to certain rules which have been discovered from an examination of nature. Perspective is essentially necessary, for we find that the Chinese works of art are deficient entirely in either linear or aerial perspective, and from that deficiency fail in producing the effect of which they are otherwise capable, being in many respects distinguished by some of the best principles of art. Geometry, of course, is the foundation of

scientific knowledge, which is necessary for all workmen, as giving them a greater knowledge of form and precision of delineation. I think the progress of art is likely to assist mechanical invention. I find that old machines, when they were originally invented, had not any beauty of form: they were of large proportions; but as they were more studied, they became simplified, and have now acquired greater grace of form from that very simplicity. The steam-engine itself is an illustration of that remark. A general use of iron in making machinery has added very much to the beauty of the steam-engine —it has relieved it from heavy cumbrous proportions. There is probably no example of a perfect machine which is not at the same time beautiful. There are some branches of manufacture in which geology and mineralogy would be extremely desirable, in order to enable a man to avail himself of the riches of the natural productions of that class. In botany, as connected with construction, in order to give a workman an insight into the nature and properties of vegetable substances, and a more accurate knowledge of their forms when he wishes to delineate or model them; all which may be very much derived from a knowledge of their growth and formation; and I should also recommend, that a general idea of chemistry, as connected with construction, should be given, as it may enable a workman very usefully to apply that knowledge in respect of dry rot, and other similar circumstances, such as the various properties of colours, both mineral and vegetable, and their great or less durability, &c. I think it very desirable that experiments on the strength of materials should also be made for the instruction of workmen, because that is a casual knowledge acquired generally by the experience of many years; whereas, if they were taught this at an earlier period, they would be enabled to avail themselves of that knowledge, and bring it immediately into operation. Experimental knowledge cannot be acquired without many failures, and some severe lessons of grave importance. I include all sorts of wood, stone, metals, cement, and mortars. It would also be very desirable if there were some models of machines and tools. At the same time, I do not think it is desirable they should be very numerous, because they would tend to confuse the mind of the workman. If the best are selected, they would ingraft on their minds similar principles, which they can carry out into practice afterwards. It would be very desirable if there were formed a school in each county, in which the materials of that district should be collected for reference and the instruction of the workmen. I have no doubt but that publications might be used as a means of more rapidly circulating and more extensively encouraging a knowledge of the arts. It is the want of such publications among operatives which has tended to continue the ignorance which already exists. The works of that class in England are very expensive, consequently they have not the means of purchasing them. I have, through the courtesy of Mr. Helder, the Prussian Consul-General, the opportunity of submitting to the Committee a publication of the Prussian Government, which originated with Mr. Beuth, his Prussian Majesty's Privy Councillor and Director to the Institute of Fabrickers and Artificers, and that gentleman supplied those specimens with introductory explanations developing their object; and its title is "Forbilder far Fabrikanten und Handwerker, herausgegeben von der Konigh, technischen Deputation fur Gewerbe, Berlin, 1821 bis 1830." The work thus published at the expense of the Government is, consequently, not for sale, and the original number of copies has nearly been distributed. This is a work of art; but there is another work devoted to science, published by the Royal Commission of Art and Manufactures, by order of the Minister of Trade, Manufactures, and Architecture, in 1830. The former of these works is divided into three parts: the first contains thirty-nine plates, all illustrative of external and internal architecture as a guide for decorations; the second part contains forty-one plates of vases, tripods, pedestals, cups, and other similar objects; the third part consists of ten plates, for the interior decoration of rooms, including floors, walls, and ceilings. This volume contains the choicest examples of ancient and modern art in their respective classes, not omitting even oriental and moresque. I have no doubt that if such a work were distributed over England, and easy reference could be had to the separate copies, the taste of our manufactures in regard to form would be materially improved. The second work, which is more especially for the use and benefit of architects, has likewise originated with Mr. Beuth, comprising plans of buildings erected in Prussia, entitled "Bau-aus führungen des Preussischen Staats" (Architectural Illustrations, by the Prussian State), issued for the public use by the Minister of the Interior. This work commences with illustrations of the simplest elements of construction and even machinery, and proceeds to give details of every species of edifice, and plans of docks and quays and other similar works. The series now submitted will shortly be followed by a further publication, comprising works of sea-ports, public warehouses, &c. Two other works for the use of carpenters and bricklayers are published for the Sunday Institutes in the Prussian monarchy, the pupils of which

have thus every opportunity offered them to acquire knowledge in their respective callings. A series of questions has been published by the Institute of British Architects, for the direction of correspondents and travellers, and for the purpose of eliciting uniformity of observation and intelligence in their communications to the Institute, comprehending queries in every department of architecture, taken in its largest acceptation, both as an art and as a science. Those have been distributed throughout Europe, and even the United States of America. I conceive such a publication to be useful, not only for the purpose of acquiring information, but in order to instigate a spirit of inquiry, investigation and thoughtfulness in the different classes of persons. The science of construction is most advanced in England. Exterior decorative architecture in France. Interior decoration, I should say, at Milan, of which some beautiful specimens are to be found in the palace of the viceroy, and residences of the Milanese gentry. From the publications which I have seen, my own opinion is, that the finest monuments of modern architecture in Germany exist at Munich and Berlin. I think the school of decoration at Milan is a very good one, having very superior professors. We have no school of a similar class in this country. Aboard a distinct class of well-educated artists, thoroughly versed in the antique, profess this branch; but in England, interior decoration is too generally confided by the employer to the mere house-painter, whose education does not fit him for the occasion. The consequence is, a degraded style of decoration in our interiors, wherever an architect has not been employed. I think that the reason of the superiority of pure taste in French improvements is from its greater appreciation generally by employers, and their yielding to the taste of the architect rather than influencing it. The greater number of our improvements have not that high character of art which they otherwise might have, from employers directing the taste of the architect, and insisting upon his adopting certain styles and forms. In England the inferior intellect directs the superior, and in France the superior the inferior. As an illustration of my observation in England, the introduction of the style of Louis XIV. decorations was against the sense of the profession, and has been forced upon them. I know an eminent artist who complained to me that he was obliged to adopt that style in the finest monument, which, within these few years, has been erected in Europe, in spite of his better judgement and his earnest remonstance. In France, under the empire, there was not any trinket, jewel or piece of furniture that was prepared for the court, that had not been either designed or approved by Percier and Fontaine. I believe that course is very much pursued now. They were so very jealous that every thing should be in good taste, that they employed a superior man to design and superintend its execution. Works can be executed much cheaper in France than here. I am the author of a work on door-ways, entitled "Examples of Door-ways, taken from Ancient and Modern Buildings" When I first had the intention of publishing this work, I submitted my drawing to four eminent engravers in this country, and requested them to furnish me with an estimate for the execution of fifty plates; the cost of them was four guineas a plate. As I had no view of profit in the work, and wished to publish it cheap, I found that if I were to pay this price, I should be unable to publish it, except at a very serious loss, not expecting a very large scale. I sent my drawings to Paris, and had estimates from four French engravers. I put the work into the hand of the best of those, a man who is second to none in Europe in his art. I had the plates executed by him. I paid the expense of the carriage of the plates to England, and the duty upon the plates of thirty per cent., incurred various other incidental expenses connected with their being executed in Paris and transmitted to England, and the whole cost did not exceed two guineas, or the half of what the English engravers required. I attributed this difference in cost to a less diffusion of the knowledge of art, and this less diffusion of the knowledge of art to a want of facilities of instruction.

(To be continued.)

NOTES AND NOTICES.

The Supplement to Vol. XXV., containing Title, Table of Contents, Index, and Plate of Specimens of English Medallic Engraving by Mr. Bate, will be published on the 1st of December next, price 6d.

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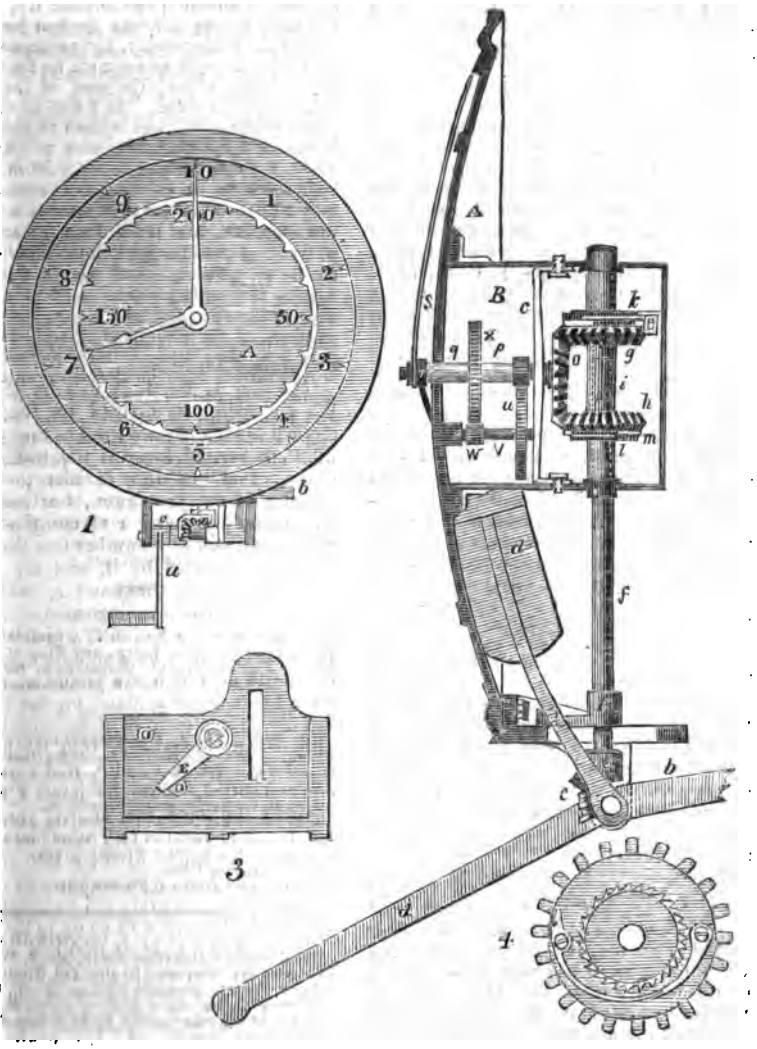
HUTCHISON'S IRON CLERK, OR TALLY-MAN.



HUTCHISON'S IRON TALLY-MAN.

Sir,—I have the pleasure of communicating to you a drawing and description of an ingenious and useful machine—the Numeroatus—matured from the fertile genius of Mr. Hutchison. It is an iron clerk or tally-man, whose business it is to register the amount of coals, &c. that are landed, from time to time, on the wharf belonging to the London Gas Company at Vauxhall, and for which service they used on previous occasions to employ two clerks.

The following is a description of the engraving which, no doubt, will be read with interest by your numerous subscribers:—

The object of this machine, as before stated, is to register the number of waggons which are raised in a day by the coal-hoisting apparatus, and which it registers on the dial A, fig. 1, to any number not exceeding 200. This is effected by the waggons giving motion, in their passage from the barges to the platform, to one of the two levers *a b*, which they perform just as they arrive at the surface of the stage.

As the machine is represented in the drawing, *a*, fig. 2, will be the lever first acted on. The waggon as it arrives at the surface of the platform comes in contact with the lever *a*, which it will raise, and cause the tooth-segment *c*, lever *b*, and weight *d*, to revolve in the same direction until the weight *d* gets a little past the centre of the spindles, when the waggon begins to descend, leaving the weight to continue the motion in the same direction, until it has exactly passed through the tenth of a revolution, when the end of the lever *b* will be depressed to the level from which the lever *a* was raised, and in which position it remains until the next waggon is brought up, when it puts in action the weight, tooth-segment, and lever *a*, in the manner before described.

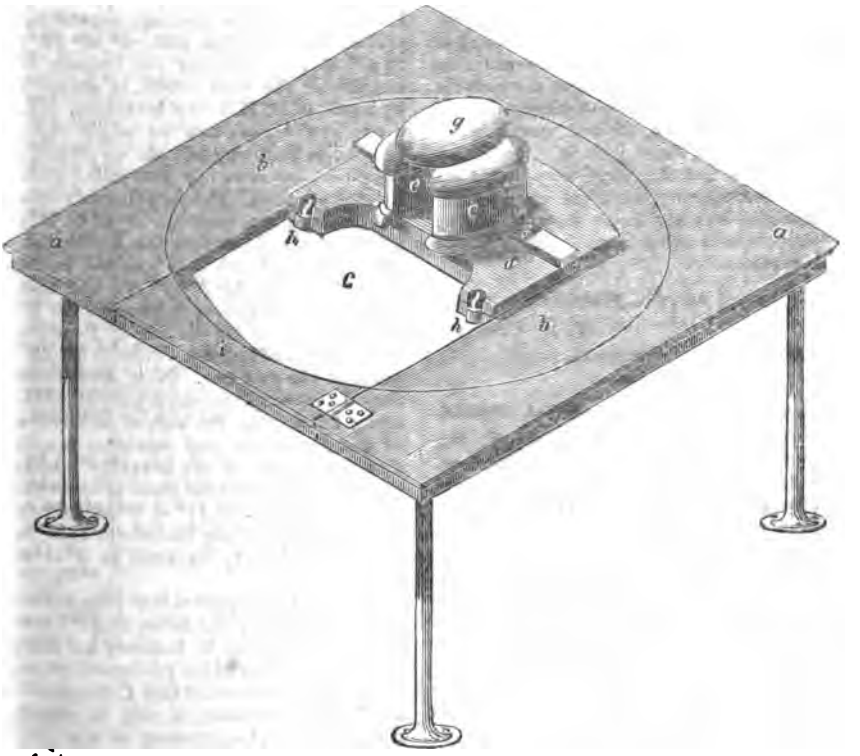
The tooth-segment *c* puts in motion another tooth-segment *e*, which is fixed to the spindle *f*; this spindle is continued through the bevel-wheels *g h* (which are not fixed to it), loose collar *i*, and ratchet-wheels *k l*; these ratchet-wheels are fixed to the spindle *f*, and turn with it. On the back of each of the bevel-wheels *g h* is fixed a catch *m*, which is kept into the teeth of the ratchet-wheel by the spring *n*; when the lever *a* is raised, the ratchet *k* carries forward the wheel *g* the tenth of a revolution, the wheel *g* acts on the wheel *o*, which is in gear with the wheel *h*, and causes it to revolve in the opposite direction to *g*, which it is enabled to do in consequence of its not being fixed to the spindle, and the teeth of the ratchets being cut in opposite directions; on the contrary, when the lever *b* is raised, the ratchet *l* moves the wheel *h*, which causes the wheel *o* to revolve in the same direction as when the lever *a* acted on the wheel *g*, and which will now be driven in the opposite direction to the wheel *h* by the wheel *o*; the wheel *o* is, therefore, caused to revolve the tenth of a revolution every time either of the levers *a* or *b* are acted on by the waggons, and is fixed on the spindle *p*, which passes through the hollow spindle *q*, on which is fixed the hand *r*; the hand *s* is fixed on the spindle *p*, and is carried on, the tenth of a revolution every time a waggon is landed on the platform, as before described.

The dial A, fig. 1, it will be seen by the engraving, is divided on the outer circle into ten divisions; and as the hand *s*, fig. 2, is carried forward the tenth of a circle, or one of these divisions, on the landing of every waggon, ten waggons will cause the hand *s* to complete one revolution, and any number less than ten will be registered by it, and all above that number by the hand *r*, which is acted on in the following manner:—On the spindle *p* is a pinion *t*, which acts on the wheel *u*, fixed on a spindle *v*, on the other end of which is a pinion *w*, acting on a tooth-wheel *x*, fixed on the hollow spindle *q*; the teeth of these wheels and pinions are so arranged, that the hollow spindle *q*, with its hand *r*, make exactly one revolution, while the hand *s* makes twenty; the hand *r* is shorter than the hand *s*, and points to an inner circle on the dial, which is divided into twenty parts. The hand *r* passes through one of these divisions for every ten waggons raised, two for twenty, and so on to 200.

B, fig. 2 is a circular iron box to contain the wheels, and to protect them from injury. C is a stay to support the bearings. D D, fig. 3, two steel stops, which prevent the levers *a* and *b*, in conjunction with the weight *d*, from causing the lever E and spindle *f*, fig. 2, to revolve

more than the tenth of a revolution for one waggon. Fig. 4 is a ratchet-wheel on a large scale, showing the catch *m*, and spring *n*.—Yours, &c. ENSOR.

TAILORS' WORK-TABLE.



Sir,—It is painful to reflect upon the injurious consequences to the health of a numerous class of society resulting from the contracted position in which a tailor perform his work; and when it is considered that it is not one of those insurmountable evils attendant on some callings, but is the result of indifference, it becomes, I think, a duty we owe to our species to endeavour to remove or alleviate the evil.

I have been induced (from a trial made for some years whether the work could be executed in all points by any other method than sitting cross-legged, as it is termed) to construct the work-table a drawing of which accompanies this article, the design of which is, to the best of my knowledge, perfectly new.

This work-table is designed for a person to sit to, it being but two feet from the ground to the under side of the board.

Description.

a a a a, is a firm-made frame of wood, two inches thick, to hold the revolving-board *b*, which is for the purpose of suiting any light; it is of wood, one inch thick, and revolves with ease and firmness on an inch projection of the outer frame *c*; the opening where the workman sits is in the model eighteen inches wide, but may be made any size without affecting the principle. *d*, the board, which exactly fits the opening. *e e*, the blocks, holding the cushions, which are wide and flat, for the purpose, when extended along

the slide *f*, of holding the sleeve-board when pressing, and when placed together, as in the engraving, form an appendage to the sewing-cushion *g*, which has an octagonal plug, made to fit a hole in the board between the cushions for pressing, a small distance from the centre, fastened by a screw to the under part of the block, on which it (the cushion) is fastened; by which double means it can be made higher or lower, or the position altered, to suit the taste or convenience of the workman. *h h*, the iron, receiving the bolt, having a hinge-joint in it, by which simple method the board may be turned into the opening, or lifted up and removed altogether, in an instant, for the purpose of basting large things. *i*, the entrance-door.

I am, Sir, yours, &c.

T. R. CROFT.

19, Moscow-road, Bayswater.

M. GUESNEY'S NEW GEOLOGICAL THEORY.

Sir,—I promised in my letter, No. 686, to make some remarks on the communication of an "Old Correspondent" (No. 682), relative to M. Guesney's new system of geology. I observe that another correspondent (O. N.) has given a solution of a question taken from Leadbetter's "Astronomy," in which he (O. N.) attempts to prove, from the said solution, that in the year 15064, London will be in the latitude of 81° 3′ 11″ N., and Edinburgh in 76° 37′ 11″ N.; and, consequently, Edinburgh will be 4° 26′ south of London! From Leadbetter's calculation it appears, that the distance of Polaris in the year 1727, was 5°. 14′ 29″ short of the tropic of Cancer, the latitude of the star then being 66° 4′ 11″ N., and its declination 88° 33′ 11″ N.; and assuming the distance between the tropics of Cancer and Capricorn to be 46° 58′, then 88° 33′ 11″—46° 58′ = 42° 35′ 11″ N. will be the *present* pole's declination when in Capricorn; and 51° 32′—42° 35′ 11″ = 8° 56′ 49″ will be the distance of the pole star south of the zenith of London in the year 15064. Some corrections might be made in the above calculation from our present improved astronomical tables; but the principles are correct, and the results are nearly true. But there is one part of the calculation, which is that of finding the latitude of London by having the zenith distance and declination of the star given, on which I must offer a remark. Does Leadbetter, in his "Astronomy," Mr. O. N., direct you to subtract the zenith distance from 90° to give the latitude of the place of observation? I am certain I may answer the question myself by saying, No. So that (90°—8° 46′ 49″) = 81° 3′ 11″ N. being the latitude of London in the year 15064, is obtained by a rule of O. N.'s own invention. Indeed, by the same rule we might make London to be in any latitude we chose to assign it, by selecting particular stars for that purpose. But Leadbetter's own calculation shows the absurdity of O. N.'s rule; he calculates that the declination of our present North Pole star will in the year 15064, be 42° 5′ 11″ N., and that the distance of the same star will be 8° 56′ 49″ south of the zenith of London, or the zenith of London will be 8° 56′ 49″ north of the said star. Now, every one acquainted with this simple part of astronomy knows that the sum or difference of the declination and meridian zenith distance of any of the heavenly bodies gives the latitude of the place of observation. Hence 42° 5′ 11″ + 8° 56′ 49″ = 51° 32′ N. will be the latitude of London in the year 15064, the same as it is at present.

It, therefore, appears that your correspondent, O. N., has fallen exactly into the same error that M. Guesney has done in the description of his geological globe, communicated by an "Old Correspondent." In conclusion, it may be stated, that the perfect agreement of the latitudes of places deduced from ancient and modern observations, fully establishes the fact, that the earth has always continued to revolve upon the same axis, and that the changes that take place in the right ascension and declination of the fixed stars is caused by a change of position of the earth's axis. It is true, if the moon were to strike the earth, which Mr. Mackintosh predicts will ultimately be the case, it would cause the earth to revolve upon a new axis, and thus would cause an instant change in the latitude of places. But so long as Kepler's laws hold true, no danger can be anticipated from such an event ever taking place.

I am, Sir, yours, &c.

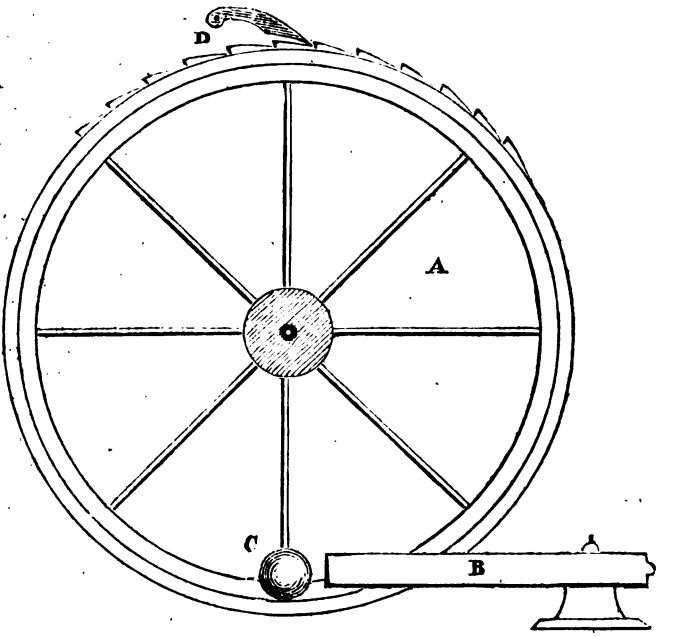
KINGLAVEN.

Nov. 21, 1836.

MR. MACKINTOSH'S ESSAY AT PERPETUAL MOTION.

Fig. 2.

Fig. 1.



Sir,—I herewith forward you a description of a machine which was constructed by me in the year 1823, with a view to produce a perpetual motion. With this machine, and the studies necessarily connected with it, first originated the suspicion that the planets could not continue in motion unless they gradually approached the centre of attraction.

In the first place, let us describe the machine. Fig. 1, A, is a sectional view of the interior of the wheel, which is formed in two halves upon one shaft; each half or section is furnished with a projecting ledge, and an opening is left between the two ledges sufficiently wide to admit of a magnet being introduced between them. By which arrangement the magnet may be brought as near to the ball as may be necessary (see fig. 2.) B is a magnet, whose line of attraction acts at right angles with the line of gravity. C is an iron ball, under the action of two forces. The magnet continually drawing the ball up the inclined plane within the wheel, and gravity continually drawing it to the bottom, by their united action it was supposed the wheel would revolve for ever, or till it was worn out; upon the same principle that a wheel revolves by the animal force or muscular action of a mouse or squirrel, which carries it up the inclined plane, whilst it is continually drawn to the bottom by the action of gravity, thereby causing the wheel to revolve by the weight of its body. The model was taken from the earth's motion round the sun; and the following process of reasoning seemed to justify the assumption that the wheel would move on till it was worn out:—

"The earth is carried round the sun by

the action of two forces, one of which is momentum, which is not, in reality, a force or cause of motion, but an effect derived from an original impulse; and that impulse, or the momentum derived from it, is not destroyed, because there is no resistance to the moving body, that is, there is no friction. Well, I cannot make this machine without having resistance to the motion, that is, friction; but to compensate for this, I have two *real forces*, two *causes of motion*, each of them capable of imparting momentum to a body; they are both constant forces; and from one of them, the magnet, I can obtain any power that may be required within certain limits."

This reasoning appeared conclusive, and the wheel was made; but when the magnet was applied, instead of the ball rolling up the inclined plane, the wheel moved backwards upon its centre. It occurred to me, that by placing a small ratchet upon the wheel, as shown at D, this backward motion of the wheel on its centre might be prevented, in which case the ball must roll up the inclined plane, and that a perpetual motion *might* then ensue; but this ratchet I never tried, having about that time begun to perceive that the idea of a *perpetual mechanical motion*, either on the earth or in the heavens, involves an absurdity—and that, therefore, the motions of the planets must necessarily carry them continually nearer and nearer to the centre of attraction. However, if any of the readers of the *Mechanics' Magazine* should feel disposed to try what can be done by adding the ratchet, I hope I have stated the principle plain enough to enable them to proceed.

Your obedient servant,

THOS. S. MACKINTOSH.

Sept. 1836.

MESSRS. SYMINGTON AND HOWARD'S SYSTEMS OF CONDENSATION.

Sir,—I might perhaps be well satisfied to let the correspondence in your journal between Mr. Symington and myself remain as it is; but one word more. Mr. Symington, I regret to notice, has swerved, more particularly in his last communication, from a fair disputation of the subject, and descended to almost personal scurrility. Nevertheless, with himself I would willingly adopt the *suaviter in modo*; but with the subject I shall not abandon the *fortiter in re*. When, therefore, I find any persons practising condensation by "the withdrawal of the warm water from the vessel in which the steam is condensed, and injecting it again amidst the steam, the heat in the mean time having been abstracted from the water," or, according to Mr. Symington's version, "by cooling down the water in the hot-well to the temperature of the external water, in order that condensation may be effected by injecting, again and again, a portion of the same water"—I shall deem such a direct infringement on the process set forth, and which has been fully realised in practice, under my patent, and shall, of course, act accordingly. The position of the refrigerating-pipe, or *other surface*, as duly noted in the specification, matters not.

In the *Vesta* a still is added to each vaporiser, and its refrigerating-pipe is placed *outside the vessel*, exposed to the wash of the paddles, by which means a supply of very pure water is obtained for the use of the engines, &c., and the salt is prevented from accumulating in the stills by allowing a small stream of water to run from the lower part of them into the ash-pit, which at the same time cuts off the communication of the heat from the ship's bottom. But the distillation of sea-water not being my invention, I consider such details or petty arrangements as altogether unworthy of a patent; and yet Mr. Symington's *external refrigerating-pipe* bears precisely the same relation to the process of condensation just described. Lastly, excepting the *position* of this pipe, the points of difference noted by Mr. Symington have already, as I before informed him, been put in practice in the *Vesta*, and are, in fact, but parts of the ordinary plan of condensation, and not at all new in themselves, as Mr. Symington must be well aware.

Thus taking leave of a discussion drawn out to a greater length than many, or perhaps most of your readers may approve,

Your most obedient servant,

THOMAS HOWARD.

7, Tokenhouse-yard, Nov. 22, 1836.

EVIDENCE TAKEN BEFORE THE SELECT COMMITTEE APPOINTED TO INQUIRE INTO THE BEST MEANS OF EXTENDING A KNOWLEDGE OF THE ARTS AND OF THE PRINCIPLES OF DESIGN AMONG THE PEOPLE (ESPECIALLY THE MANUFACTURING POPULATION) OF THE COUNTRY; ALSO TO INQUIRE INTO THE CONSTITUTION, MANAGEMENT, AND EFFECTS OF INSTITUTIONS CONNECTED WITH THE ARTS.

(Continued from page 144.)

Mr. Noel St. Leon, examined.

I am connected with the paper manufacture. As a draftsmen and pattern drawer; my profession is not very numerous; but *there are more than are enabled to live comfortably. There are more draftsmen than are required.* In the metropolis connected with paper-hanging, I should say there were not more than twelve. The present taste is more classical, is more built on the antique and more architectural; but it is also, in other respects, infinitely more fanciful than it was. It has gone two ways. I was originally intended, like many other persons, to be an artist; but finding I could not live as a painter, I attached myself to my present employment. When I joined it, flowers were the principal objects in fashion. They are now nearly supplanted by classical forms and objects of fancy. There has been a much greater development of mind within the last twenty years than at any preceding period. I mean that in consequence of the perpetual craving of the public for novelty, manufacturers are under the necessity of issuing a six-monthly supply, by which means the invention of the artist is kept in a constant state of activity for the production of new forms, new combinations, and new arrangements, which we call invention. The difference between the English and French productions in paper-staining is this, the French confine themselves to the imitation of objects with which the community at large is acquain'ed, such as landscapes, cameos, fringes, draperies, costume, hunts, battles, &c. Of those materials, their larger paper-hangings are composed. We rather deal in original subjects producing new inventions, fancies, combinations, and arrangements.

Mr. D. R. Hay, House-Decorator of Edinburgh, examined.

I believe the merchants in Glasgow get designs from France, and send them direct to Paisley, where they are copied. The best Scotch carpets are manufactured, the best with regard to design, I believe, in Edinburgh; Mr. Whytock, of Edinburgh, produces the best designs; he keeps a designer, who has also an assistant, and he has been extremely successful; his present designer was coming out as a portrait-painter, but Mr. Whytock, by giving him a good salary, turned his attention to the designing of carpets. The Persian carpets have a peculiarity in them that distinguishes them from every other kind of ornamental design; so have the Turkey carpets, so have German goods, and the French have also their own peculiarity—but we have none, ours are generally like the French; I conclude, therefore, that most of our ornamental manufactures are borrowed from the French. We have no designers by profession in Scotland, except those employed in the manufactories. I attribute this want of originality, in the first place, to the want of the dissemination of instruction amongst manufacturers and the working classes generally, as also to the want of enthusiasm and spirit in the master manufacturers themselves, probably arising from the difficulty of protecting the copyright of such designs as they might procure by employing proper artists. I have found the want of such protection myself; for even a patent that I procured in 1826 was no protection; my neighbours, as soon as they knew the principle, practised it openly. But this is no great hardship to me, as those who copy the designs of others are generally inferior workmen, and, of course, do not execute them in proper style. It being done by the hand, they cannot be so well imitated as designs which may be transferred to block-printing or weaving. They cannot be multiplied to the same extent; but to the manufacturer it must be attended with very serious consequences. The manufacturers with whom I am acquainted, who have any enthusiasm in their business, complain much of the want of protection for their designs. A system of registration, by which priority of right could be ascertained, would be very simple. It ought not to be the registration of a drawing or any thing of that kind, it ought to be the article in a manufactured state; because were it a drawing, no board of practical people could so easily detect the similarity between a drawing and a manufactured article as they could between two manufactured articles. I find, in my own trade, great difficulty in workmen getting into any thing like a knowledge of art; but were they taught early, they would be as far advanced at the commencement of their apprenticeship, as they now are after being two or three years at the trade. Most of my ornamental painters get from 20*s.* to 25*s.* and 30*s.*, and some as high as 36*s.*, according to their ability and the style of work they do. In Edinburgh, I believe the artists in the higher walks, or those who attempt to follow the higher walks,

are much more numerous than those who are in the habit of designing ornaments. And this I consider an evil, in so far as the arts and manufactures are connected; and I believe it arises from the ornamental art not holding a proper station among the other arts of design, that is to say, not being sufficiently respected. I have made applications to young men whom I knew to be in circumstances of difficulty, to leave landscape-painting, and I would give them a good salary; but I never could get them to do it. After being once artists in the painting of pictures, I never could get them to descend to the more humble profession.

Mr. George J. Morant, House-Decorator, New Bond-street, examined.

I have felt the want of the power of procuring a sufficient number of good designs; and a great difficulty in having one's own wish and designs carried into execution. When I have had designs, it has frequently been a matter of great difficulty to get workmen to enter into the proper feeling of giving effect to what was wished to be produced. I would refer more particularly to any thing connected with the superior branch of ornament, whether it may be in ornament of forms, or of modelling, or of the decoration of rooms, that requires a particular or precise style to be kept up. I believe there are very few good modellers or carvers in London to be had. Of the modellers that exist, there are a considerable portion of them strangers. I do not know half a dozen persons in London that we could apply to, at the present moment, to execute some things which have been done. I might refer, for instance, to a specimen of painted arabesque as an illustration of what I mean. This is a specimen of painted arabesque [*producing it*]. The design would have been very difficult to have been obtained. I was obliged to apply to a foreigner for the design of this. But the execution of it (the greater part) was done by our own artists, who are always in our own employ. The design is Italian, partly Pompeian. Our artist is an Englishman; and he has never been in any other establishment. He was brought up by my father, and has been with us twenty-five years. I did not make any application to any English artist for the design previously to applying to a foreigner. This is a very peculiar design; we wished to make the rooms as perfectly Italian as possible. It is impossible from this slight portion of it to judge of the beauty of the whole thing; the ceiling is forty feet in length, and painted in a very different style to what is done abroad in the cafés, although the things that one sees in Italy, in the cafés, are perfectly astonishing; *but they would not finish them in the way this is finished.* I think I could safely say that, with the assistance of a German work, and some of these works, I think, would be of infinite use to decorators in this country. I refer to a publication of Zahn, of Berlin. For those who wish to have this particular style of decoration, they would be invaluable as subjects to refer to. At this moment we are having a carpet made from one of the borders. These specimens of Zahn are all taken from different palaces. The titles of the books, translated, are:—"Book of Ornaments for the Practical Use of Architects, Decoration and Room-Painters, Carpet Manufacturers, Silk, Wool, and Damask Weavers, &c. By C. Bottieker. Berlin, 1836."—"Ornaments of all Classical Epochs of Art after the Originals. By Professor William Zahn. Berlin, 1831."—"Ornaments in the Practical Use of Room-Decorators, with an Illustrative Text. Published by J. F. Stodh."—William Zahn was sent by the desire of the Austrian Government to collect them for the purpose of improving, I imagine, the interior decoration of the rooms. The dissemination of such designs, if found of utility in a nation like Prussia, would be likely to be much more advantageous to a country like England, whose manufactures are infinitely more extensive. The predominance of the taste for the style of Louis Quatorze, indisposes the public to encourage specimens of pure Greek decoration. I think it is a captivating style of art to the uneducated in art, from its requiring a great deal of gold and gilding, and which, therefore, generally produces a magnificent effect, though sometimes the forms may be very disagreeable. It is not only more striking, but more easy than the classic style. When those two qualities meet, it is a temptation to an artist to go into it. It is very seldom you see it in a pure state, as what it was formerly at Versailles. The corrupted taste arises in a great degree from the public not having received a good education in art themselves. *In all ranks of society that is my decided opinion, that the evil is among all classes not having, I was going to say, an eye for taste.* The exclusiveness of exhibitions is an impediment in the way of the public, so that the public cannot be so well informed on matters of taste—and, therefore, cannot appreciate them so fully as foreign nations can, where they are more open. I feel convinced that it is partly owing to the public on the Continent having that sort of access to the objects constantly, that tends to generate a better feeling and better taste and love for the arts than generally people have in our country. *I find that among many workmen of intelligence there is a great desire to acquire a knowledge of art and of taste.* I think these works (the German publications above described) would be very useful to the carpet manufacturers; I

think carpets are very much improved. I should like just to have shown one or two papers, *which I consider will prove the capability of the English manufacturers for producing a fine paper.* [*The witness produced some.*] I do not think the repeal of the duty would tend to encourage the superior papers to any great extent. It may encourage the use of inferior patterns, because the duty was an equal duty upon the common priced paper as well as the expensive paper. If the duty is taken off paper, and if the paper principally relieved by the removal of the duty is the inferior sort of paper, the great mass of the population would be able to appreciate art, inasmuch as it would encourage good art more extensively in the lower sorts of paper. There are papers had now at 3½*d.* a yard of a better style of pattern could then be had at 3½*d.* than can be at the present moment.

Mr. Edward Cowper, examined.

I am the patentee of the Applegath and Cowper steam printing-machines. We manufacture the principal steam newspaper and book machines; the machine at the *Times* office was the joint invention of Mr. Applegath and myself. As an instance of the advantage of the application of arts to manufactures, I would state the revival of the Etruscan *terra cotta* works, which has recently sprung up in London. A few years since, having observed at the British Museum the beauty of the contrast of the black with the red in the Etrusean vase, I procured some common garden-pots, and that equally common varnish called Brunswick black, and taking a few of the antique ornaments and figures, I painted those pots, and found they produced a very pleasing effect. Some time after I thought it was a pity that this idea should drop, and I went into the shop or depôt of the Lowesby *terra cotta* works, Adelaide-street, which belong to Sir Frederick Fowke and Mr. Purden, where all the articles that were manufactured were simply of the colour of the red earth. This clay is found on the estate of Sir Frederick Fowke, and was, in the first instance, manufactured into pots merely as a matter of taste. On finding a great demand for it, he converted it into a manufacture. He confined it, first of all, to his friends; it was only on account of the great demand for it that he converted it into a manufacture. I now come to the point; the facility with which art, by a little instruction, may be introduced into a manufacture, and previous to the demand existing, I purchased one of their pots, and painted it somewhat in this style [*producing one*]. I told Mr. Purden he was welcome to the idea, if he pleased; I did not want any advantage from it; it was merely a matter of taste. He took up the idea, and now they sell more of this black and red ware than they do of the old. I have mentioned the facility with which art may be introduced into manufacture, and you see that in this case it was effected merely by my giving a little instruction to the master. I will now point out the difficulty attending the introduction of art into manufacture; this arises from the men; the difficulty is owing to the ignorance of the men. The men have been accustomed to make a straight line flower-pot, and therefore they cannot think there is more taste in making it curved. I endeavoured to give Mr. Purden some idea of the principles of beauty of form, which I had myself learned from a lecture by Mr. Reinagle. I was in hopes Mr. Reinagle would have been here to explain them himself. It is very important, as showing how very easily these principles may be taught. Mr. Reinagle called his lecture a lecture on the oval, but he merely adopted the term "oval" to signify curved lines of an elliptical character, and he showed that if the outlines of the vase were made portions of an oval, it would be a graceful form; and it is really surprising to see how, with this principle, you may vary the forms of vases, and yet produce graceful results. If once the workman had the idea of the oval in his mind, he would never make a bad vase. Not only the forms of many of the vases or pots are new, but the figures painted on them are new; all the figures might certainly be taken from the antique, but they may also be taken from the outlines of Canova, or any other modern sculptor; in fact, the outlines of statuary of all kinds would be appropriate ornaments for *terra cotta* vases. A rich store of subjects may be found in the works of Sir H. Englefield and Moses. This style does not bear any resemblance to Mr. Wedgwood's. His imitations were of finer material, and the ornaments were burnt in, and they were very expensive; these are of a more ordinary character altogether, and yet are very pleasing: Mr. Wedgwood has improved the forms of pottery, and diffused them more than any other person, but he retained a little of the prejudice of keeping art at a high price. His imitation of the Portland vase was justly celebrated; but after he had sold thirty of them at twenty-five guineas each, he destroyed the mould, in order to render them more rare, and that I consider a very erroneous feeling, because it was so far preventing the diffusion of taste throughout the country. Another instance of the introduction of the arts of design is in the manufactory of *scagliola;* the antique forms and figures are introduced into slabs, pilasters, &c., and that by means of machinery. [*The witness also produced several other instances, shewing that the recent introduction of design*

in several manufactures has greatly multiplied the extent of the manufacture.] Now, the ease with which the principles and illustrations of art might be diffused I think is so obvious, that it is hardly necessary to say a word about it. Here you may see it exemplified in the *Penny Magazine*, and here are 150 cuts taken from the *Penny Magazine*, many taken from the old masters, of painting and sculpture, and many of them very well done; and these 150 cuts, printed on drawing-paper, and well bound, may be had for 14*s*. Such works as this, and the *Saturday Magazine*, *Chambers' Journal*, and the *Magasin Pittoresque*, and the *Magasin Universel*, of Paris, could not have existed without the printing-machine. And every Saturday I have the satisfaction of reflecting, that 360,000 copies of these useful publications are issued to the public, diffusing science, and taste, and good feeling, without one sentence of an immoral tendency in the whole. In fact, the mechanic and the peasant, in the most remote districts of the country, have now an opportunity of seeing tolerably correct outlines of form which they never could behold before, and literally at the price they used to give for a song. The art of wood-engraving itself has received an astonishing impetus from these publications. The engraver, instead of working merely with his own hands, has been obliged to take five or six pupils to get through the work. Mr. Knight expends more than 2000*l*. a year in wood-cuts. They are even exported; 400*l*. worth were sent to the *Magasin Pittoresque* in one year. They are also stereotyped and sent all over the Continent. As a further instance of the means of instruction by the printing-machine, perhaps the Committee will allow me to mention, that Mr. Clowes has twenty of my printing-machines, and he has turned out, on an average, 2000 reams of paper in a week, and the great mass of this work is certainly on the side of rectitude; it is all tending to good. Popular instruction is the grand occupation of the printing-machine. Of an 8*s*. volume on "Political Economy," perhaps 750 copies might be sold in two years, and teach the rich the advantage of machinery, but would never reach the poor; whereas, of the little 1*s*. work, called the "Results of Machinery," 25,000 copies were sold, and in the hands of the poor, in three months, and checked, in a most decided manner, the burning of threshing-machines and other farming property.

Mr. Edward Cowper and Mr. Cheverton examined.

Mr. Ewart (*to Mr. Cowper*).—Are you aware that ivory is applied as an article to the purposes of art to any great extent in this country?—I am not aware that it is, the beautiful ivory busts by Mr. Cheverton are the only specimens I know. [*Referring to some ivory busts before him.*]

You are aware that there is a considerable importation of ivory into this country?—Yes.

But it is not generally applied to the purposes of art?—I believe not.

Are you aware that in France, ivory is extensively applied to that purpose?—I cannot speak from experience, not having an opportunity of seeing them when I was in Paris.

Are there no instances of ivory being applied to the purposes of art in this country?—The only I know is by Mr. Cheverton, of 72, Pratt-street, Camden Town.

Describe the process by which art is applied to ivory in that case?—The precise process is a secret, but the general principle is this: a lever turning on a fulcrum at one end is furnished with a tracing point at the other end, and between the tracing point and fulcrum there is a drill in rapid motion; as the tracing point is carried over the model, the drill travels over and carves the ivory. Mr. Watt, as far back as the year 1800, was engaged in the application of machinery to the production of medallions, and he was occupied in these and more extended analogous pursuits down to the close of his active life. They formed the favourite amusement of his declining years; and during that time he succeeded in producing the round figure, by mechanical means, both of a size similar to, and reduced from, that of the original. Mr. John Isaac Hawkins, civil-engineer, unacquainted with Mr. Watt's proceedings, succeeded also in accomplishing the same objects in the years 1814 and 1815. He was subsequently joined by Mr. Cheverton, and an entirely different and greatly improved machine was produced by them in the year 1828, by which the specimens of ivory sculpture now before the Committee were executed. The same principle, I conceive, might be applied to engraving dies, and I understand Pistrucci is now engaged in experiments on the subject.

Dr. Bowring.—The perfect identity of die would be of great value to the national coinage?—Yes, of course. I consider that Mr. Cheverton has introduced an entirely new art, which consists in making by machinery, a reduced copy in ivory, in any proportion, from the original bust or figure.

That is the reduction in any proportion?—Yes.

Has it the same power of increasing the proportion?—No, it cannot.

But it can make it the size of the original?—The first machine made by Mr. Hawkins did actually carve a figure the same size as the original, but the machine Mr. Cheverton

now uses could not do so at present; but he could soon arrange a machine to cut the same size as the original, if it were wanted. The maximum at present is half, and the minimum one-tenth. Mr. Cheverton has sometimes made a double reduction; that is, he has taken it at one-fourth, and then taken that reduced copy as an original, and reduced it one-fourth again, that is $\frac{1}{16}$th. He has a little figure of Cupid, so small that it might be used for a brooch; it is $\frac{1}{16}$th of the original.

Mr. Ewart.—Will you mention the exactness with which it is done?—The bust which I now show the Committee is a copy from Sir F. Chantrey's model of Sir Robert Peel, which was to be executed for the King, at Windsor, and is in every respect a perfect copy of the original; indeed, it cannot be otherwise, for the model is the tangible or mechanical guide to the instrument which carves the ivory. This is $\frac{1}{16}$th of the original model. (*Mr. Cowper exhibits a small bust.*)

To Mr. Cheverton.—Will your machine cut marble?—It will; it is not impossible to do so, but it is not in practical use on account of the hardness of the material.

Dr. Bowring.—Might it not be applied to medals, either in steel or bronze?—*Mr. Cowper.*—With some alteration I think it might.

Would it do for alabaster?—It would cut that very well, but it is too fragile a material to cover with elaborate art.

Has there been a demand for the productions of the character you have been describing?—It is but little at present, not near so much as it deserves; I consider that to be entirely owing to its not being generally known.

As far as it extends, has it an increasing demand?—As far as the knowledge of it extends, it has decidedly; but there can be no demand for these beautiful productions when there is no knowledge of them. I should think no gentleman present could see without admiring them.

Is there so much of mechanical perfection in the instrument, that an increased demand would tend to lower the price, or is the high price of it dependant on the present small demand in consequence of its being not generally known? *Mr. Cheverton.* — The high price depends on the material; it is two guineas a bust, on an average; and secondly, on the time that is taken; and thirdly, on the talent or tact, to say the least, that is necessary in conducting the mechanical operation.

Can you say whether an extensive demand would lead to a considerable reduction of price?—From those particulars it will be seen a demand could not lower the price in any one of these particulars.

Does it not require some intellectual direction?—Certainly it does. *Mr. Cowper.*—Mr. Cheverton has a little of the feeling common to artists against making art cheap. I take an opposite view of the case. I think the cheaper an art is, and the more it is diffused, the greater the demand will be; and if there were to be a demand for those busts, I would undertake to manufacture them at half the price; inferior artists should be put to do the preparatory work, and Mr. Cheverton himself should put the finishing stroke. There is a carving machine invented by Mr. Gibbs, in use at Croggon and Co., Pedlars' Acre; it will not do such work as Mr. Cheverton's; it will carve marble, but not with advantage, but it carves scagliola and oakwood beautifully, and produces very exact inlaid work. The projecting wood letters over the shop-fronts are cut by this machine.

Mr. Wyse.—If applied to oak or hard wood the expense would be considerably lessened?—Yes, and I have seen the most elegant parquetry floor made by it, which would be too expensive to be attempted by hand. Much, if not all, the Gothic oak carving for the New Houses of Parliament might be done by it, and with Mr. Tulloch's machinery in Esher-street, almost all the Gothic stone mouldings might be executed; so that by this application of art to manufacture the splendid palace of the Legislature might itself be increased in splendour.

Could it be used for working in wood for wainscoating and for ornaments?—Yes, and there would be no difficulty in doing this.

Is the machinery expensive?—I believe not; but they have a patent for it, and confine it to themselves.

[The remaining and greater part of the evidence taken during the last session, relates to the management of the Royal Academy, and is, therefore, unsuited for our pages. Some of the answers given on this part of the subject, however, have such a practical bearing on certain points on which we have the misfortune to be in the minority —namely, the alleged inferiority of England in the arts of design, *in consequence* of the want of schools of design, and the alleged inadequacy of the commercial principle to produce in each country what is the best for each country—that we must trespass yet a little further on the patience of our readers while we extract them. England is before all other countries in the art of engraving. How is this? Because of the encouragement which it has received from Courts, and Academies, and (endowed) Schools? No; but because through the impetus given to it by the natural demands of commerce, it has flourished in this first of commercial countries *in spite* of all that Courts, and Academies, and Schools, could do to cast discredit upon it. Engraving is one of the few things which

have been *let alone* (except as to the discredit); and therefore it is, that it has flourished so exceedingly. Sir M. A. Shee says, in his evidence, "The moment you make art a trade, you destroy it." The historical fallacy of this is so prodigious, as to need no comment. The art of engraving has been made a trade, but only to become the first of all trades in point of prosperity, and, we trust, (as lovers of art and of independent commercial enterprise) in point also of remuneration.]

John Burnet, Esq., Engraver.

I do not think we are inferior. *If called out, I consider there is more talent in Great Britain connected with the fine arts than in any place in the world.* The historical painters of this country are better than those of France and Germany; and I have seen exhibitions in both countries certainly as far as correct drawing goes, or severity of outline, which are perhaps superior to us; but in the general arrangement, in the knowledge of light and shade, and in the distribution of colour they are very inferior. There never was a period in which there was such a diffusion of beautiful engravings. There is a great quantity now from the introduction of engraving on steel, though I do not know that a greater number of impressions is taken from large works. In the year 1775, for example, they used to sell as many impressions of a fine print as now of some of Woollet's and some of Strange's; there were sold as many as 1300, which was considered a very great number.

John Pye, Esq., Engraver.

Does the Royal Academy of Arts in London extend protection or encouragement to the art of engraving?—It appears that the laws of the Royal Academy of Arts admit to academical honours historical painters, landscape painters, portrait painters, flower painters, sculptors, architects, die engravers, watch chasers, and enamel painters, professors of each of those branches of art having been academicians, as the catalogues of the Royal Academy testify; but that all classes of engravers, excepting die engravers, are excluded from academic honours, nor can I learn that engraving has ever derived any protection or advantages from the Royal Academy; on the contrary, the constitution of that establishment, instead of excluding engravers altogether, as may be presumed it ought to have done, if engraving were deemed by those who made its laws unworthy to rank with the many other branches of art just mentioned, has not merely deprived engraving of that rank in England which is assigned to it by all the academies of art on the continent of Europe, but it has attached to that profession a mark of degradation that does not attach to any other branch of the fine art, however low its claims may be; and it is worthy of remark, that Sir Robert Strange received from the King the honour of knighthood for his skill in the practice of that art which had rendered him unworthy of belonging to the Royal Academy, whereby he became distinguished as an engraver above all the royal academicians, excepting Sir Joshua Reynolds and Sir William Chambers.

What is the actual state of engraving in England in relation to its state on the continent of Europe?—The art of engraving appears to have advanced in England through the influence of growing intelligence and our national commercial spirit, and stands in the opinion of foreigners, higher than in any other country. In evidence of that fact, I beg to refer to the employment given to English engravers, both at home and abroad, for works to be published abroad; to our intimate acquaintance with the French; to the well-known fact of young foreigners coming to England under the protection of their respective Governments to study the art of engraving; and lastly, I beg to state, that the Duke de Cazes, formerly ambassador of France at the Court of Great Britain, and subsequently first minister of Louis the Eighteenth, told me in Paris that whilst he was minister of the king, he conceived a project of sending young engravers to England, to study those qualities of that art for which the English are distinguished; as is the custom of different academies to send young painters to Italy to study painting; but that a change of the ministry prevented his purpose being effected. The best plates engraved now appear to me as being free translations from pictures, instead of being cold rigid copies. They are entirely so with regard to effect—that quality by which the English school is distinguished, whether we speak of painting or engraving. The painter produces his picture by the aid of forms, lights and shadows, and varieties of warm and cold colours. The engraver copies the composition of the painter, and produces his effect, aided merely by different strengths of tints and gradations of black and white; and the most successful engravers often produce effects, with these very limited means, which fill the minds of the spectators with a consciousness of the magnitude and great pleasurable varieties of nature (with very few exceptions) beyond any thing formerly done.

Has not the more direct association of the art of engraving with literature been one

of the main causes of the great number of works executed?—It appears to me that the mind expands as it becomes cultivated, and a greater desire for every thing that emanates from the exercise of intellect is created; hence results the encouragement for literature and the fine arts.

Then, if I understand you right, engraving partakes in England more of the character of a fine art than in any other country?—That is my belief.

And yet the English engravers stand lower as artists, in point of distinction, than the engravers in foreign countries?—An engraver who has attained but moderate rank in this country has only to travel abroad to ascertain that fact, for he becomes, by being transplanted, another person in point of weight and consideration in society.

But with respect to his own pecuniary prosperity, is not more patronage done by literature to English engravers than is done to foreign engravers by any honorary distinction?—Speaking of engraving in a pecuniary point of view, engravers derive considerable advantage from being employed to embellish books, and but little from that employment which would elevate their art, and by which they would wish to be distinguished.

But what do you attribute the great increase of the numbers and the great increase of demand for engravers?—It is the commercial spirit and growing intelligence. It appears to me that the art of engraving has attained considerable importance in this country, not only in the opinion of the English, but in the opinion of all the civilised nations in Europe, by its application principally to the embellishment of books. The English engravings, I think I may venture to assume, have in that shape penetrated into all the civilised countries in the world, but little has as yet been done for the encouragement of the art in this country in the way that it has been encouraged in France, and that way is, as it appears to me, almost exclusive on the continent, that is, in its application to the decoration of rooms. In France I believe that it is almost impossible to go into any house of civilisation, and not find against the walls some prints framed and glazed. The power of indulging in the same pleasure in this country appears to me beyond the reach of the people, generally speaking, on account of the very high price of glass. This is the point on which I desire to speak: I have procured, at the suggestion of an honourable member of this committee, a list of the prices of glass in France, and also a list of the prices of glass in this country. The French glass in appearance, for all the purposes to which I alluded, is very much superior to the English glass. I am told that the glass trade in England is in the hands of a very few wealthy persons; that those individuals who might be disposed to speculate in the art of making glass, are prevented doing it by the great quantity of money required, and more from the duty that is paid to the Government than any thing else.

Will you put in the list of the prices?—Yes.

[*The following list was then handed in.*]

Inches.	England. £	s.	d.	France. £	s.	d.
26—24	0	16	6	0	2	0
28—24	0	18	6	0	2	3
32—24	1	3	0	0	2	9

I inquired as to the quantity of glass that is imported in consequence of the superiority of the quality over the quality of the English, and the person who was good enough to give me this information, being one of the greatest importers in London, stated that they have altogether ceased to import French glass, in consequence of the duty on British glass having been reduced. The import duty on French glass is 10*l.* per hundred-weight, the duty on English glass is 1*l.* per hundred-weight. You will perceive that the duty of 10*l.* per hundred-weight amounts to a prohibition. He says that the duty on a piece of French glass that costs 2*s.* 9*d.* is 10*s.* I am not aware that I can add any thing to the communication that I have already made, except any thing that may tend to show the value of engraving in a commercial point of view, or in allusion to the encouragement it received before the war, when Mr. Alderman Boydell published so many prints which found their way into almost all the houses of civilisation in this country. I have looked a great deal into the dwelling-houses of the people in France, and I have seen their rooms covered completely, all over with engravings, while in England the same class of persons have not any.

THE INSURANCE-COMPANIES *v.* THE PUBLIC.

Sir,—From the manner in which P. R. argues the question of "Public Security *v.* The Insurance-Companies," in his communication respecting Mr. Braithwaite's steam fire-engine, in your last Number (p. 116), it is quite evident that he has taken a very incorrect view of the

matter. I am aware that P. R. stands not alone in his view of the case—the misunderstanding is general; I must, therefore, request a corner for the following remarks, which are intended to put this affair in its proper light before your readers.

P. R. speaks of *the public security*; it would be well to consider, who are the *public?* And what is meant by the *public security?* With reference to our present inquiry, the *public* are divided into two great classes, the *insured* and the *uninsured.* The Insurance-Companies guarantee themselves to the first class, to make good the amount of all losses by fire upon the insurers paying them a certain agreed (and for the most part a trifling) premium. The number of the *insured* is such, as to have the effect of placing about one-third of all the property in the metropolis at the risk of the Insurance-Companies. These Companies, knowing the disgracefully defective means possessed by the *public* for extinguishing fires when they occur, consider a portion of their receipts well laid out, in providing a certain number of firemen and engines, stationed in the most advantageous situations over the metropolis, to endeavour to circumscribe as much as possible the extent of damage by fire.

This the Insurance-Companies do, in order to protect and preserve, to the utmost of their power, *their own property*, *i. e.* property which they are bound to replace, if lost or damaged by fire.

In effecting this object, as a matter of course—in fact, as a matter of necessity—they also protect, to a very great extent, the property of the second class, or *uninsured* portion of the *public,* in which they can have no real interest.

It should be borne in mind, that the insurers do not pay the Insurance-Companies *for putting out fires*—but, *to make good any loss* occasioned by fire. So long as the Insurance-Companies continue solvent, the insured have no grounds for complaint; because, if the firemen are unable to stop the progress of the fire, the Insurance-Companies are bound to make good all losses to the amount insured.

Under no circumstances have the *uninsured* any right to complain; if they choose to take all *their own risk*, and provide no kind of protection against accident by fire, whose fault is it, if they are occasionally *losers by their speculation?*

There is a constant ratio between the amount of business done, and the expenses incurred, in fire-insurance, as well as in every other trade; and I dare say the Insurance-Companies are of opinion, that their present force is as great as their business will support, and sufficient to protect the property lying at their risk. Let the *second class* become insured, and all the property in the metropolis be placed at the risk of the Insurance-Companies, then see how soon they would increase their fire-engine establishment; their amount of income being tripled, would enable them to do so. The public will not, as P. R. states, "be led to *suspect*," but, if they view the case aright, they will positively *know* "that it is *not* the Insurance-Companies' interest that property should be secured against casualty by fire" (AT THEIR EXPENSE) "beyond a certain extent." That is, beyond the extent of their own liability.

We are continually hearing the *public* find fault with this, that, and the other; the public occasionally take upon themselves to dictate to the Insurance-Companies as to the power of the engines, and the number of the firemen they should employ; just now some ill-advised persons would fain cram steam fire-engines down their throats, albeit, it appears, "they fancy they can do better without their aid." I believe, if the Insurance-Companies thought it advantageous to *their interest* to employ a steam fire-engine, they would soon have one; but, if they are of opinion, that a machine of this kind would not afford protection adequate to the expense it would entail, of course they have an undoubted right to judge for themselves; I hold a different opinion as to its utility. As well might the potent *public* call upon any machinist and say, "Although you have hitherto found *manual labour* sufficient for the purposes of your manufactory, it is possible your business may suddenly increase; we, therefore, desire that you will henceforth employ a powerful steam-engine to drive your lathes, &c."—or, to call upon my neighbour, and say, "It is true you have as yet found a horse and cart amply sufficient for the requirements of your trade, nevertheless, the *public* desire you will immediately pro-

vide yourself with a waggon and six horses"—as to call upon the Insurance-Companies to adopt any particular machine, or to incur any additional expense, inconsistent with the amount of business they are doing. In all these cases the same answer might very justly be given—will the *public* place the necessary funds at our disposal? If so, we shall be most happy to avail ourselves of this additional power.

P. R. says, "the option of rejecting or accepting Mr. Braithwaite's steam fire-engine becomes a matter for the *public*." Now, is it at all likely that the *public* will do any thing in the matter? The *public* have hitherto treated the subject of protection from fire with such reprehensible apathy; that while comparatively small provincial towns have been provided with a well-organised and efficient *fire-police*, the preservation of the millions of property in this vast metropolis has been permitted to depend upon chance! All the wholesome legislative enactments, tending to check the spread of fire, have either been cunningly evaded, or set at open defiance—and yet who so ready to cavil and complain as this same upright *public?*

Perhaps no person has less reason to take up the cause of the Insurance-Companies than myself; seeing that I have made greater sacrifices, both personal and pecuniary, in their behalf (my circumstances and station in life considered) than even Mr. Braithwaite—not only without receiving the slightest advantage, either directly or indirectly, but without even thanks for my pains. Nevertheless, I am of opinion, that much good will ultimately of necessity arise, to all parties, by a more correct understanding of the true relations existing between the *public* and the Insurance-Companies. For the *public* to call upon those who ever have been, and must continue to be, *irresponsible to the public* for the manner in which they choose to conduct *their own business*, is something worse than foolishness. Let the *public* take what share of the risk they please, but let them protect that share, as well as the Insurance-Companies protect theirs, and we shall hear but little complaint about the spread of fires in future.—Yours, &c.

WM. BADDELEY.

London, Nov. 22, 1836.

LIST OF ENGLISH PATENTS, GRANTED BETWEEN THE 22ND OF OCTOBER AND THE 24TH OF NOVEMBER, 1836.

Jeremiah Crook, of Liverpool, merchant, for certain improvements in the machinery for manufacturing hat bodies; being a communication from a foreigner residing abroad. Oct. 28; six months to specify.

Thomas Edge, of Great Peter-street, Westminster, gas-apparatus and lamp-manufacturer, for certain improvements in lighting or illuminating by gas, oil, or spirit-lights or lamps; being a communication from a foreigner residing abroad. Oct. 28; six months.

Robert Copland, of Courlands, Wandsworth-road, Surrey, Esq., for improvements upon patents already obtained by him for combinations of apparatus for gaining power. Nov. 5; six months.

James Elnathan Smith, of Liverpool, merchant, for certain improvements in railways and on locomotive-carriages to work on such railways; being a communication from a foreigner residing abroad. Nov. 8; six months.

John Whitcher, of Ringwood, Hants, carrier, for improvements in drags or apparatus applicable to carriages. Nov. 8; six months.

James Smith, the younger, and Francis Smith, both of Radford, Nottingham, mechanics, for certain improvements in certain machinery already known for making bobbin-net or twist-lace. Nov. 8; six months.

Joel Linsey, of Bury, Lancaster, cotton-spinner, for improvements in machinery used for spinning, preparing, and doubling cotton, and other fibrous substances. Nov. 10; six months.

Bertie Paterson, of Peacock-street, St. Mary, Newington, Surrey, engineer, for certain improvements in the construction of meters or apparatus for measuring gas or liquids. Nov. 12; six months.

Henry Augustus Wells, of the city of New York, but now residing in Threadneedle-street, London, for certain improvements in the manufacture of hats. Nov. 15; two months.

Fletcher Woolley, of York street East, Commercial-road, Middlesex, gentleman, for improvements in the manufacture or preparation of materials to be used as a substitute for bees'-wax; parts of which improvements are applicable to other purposes. Nov. 15; six months.

John Yule, of Sanchiehall-street, Glasgow, practical engineer, for improvements in rotatory-engines, or an improved rotatory-engine. Nov. 15; six months.

Augustus Applegath, of Crayford, Kent, calico-printer, for certain improvements in printing calico and other fabrics. Nov. 15; six months.

Joseph Whitworth, of Manchester, engineer, for certain improvements in machinery for spinning and doubling cotton, wool, and other fibrous substances. Nov. 19; six months.

William Norris, of Alston, Cumberland, land-surveyer, for certain improvements in the manufacture of combs; being a communication from a foreigner residing abroad. Nov. 19; six months.

John Gordon Campbell, of Glasgow, merchant, and John Gibson, of the same city, throwster, for a new or improved process or manufacture of silk, and silk in combination with certain other fibrous substances. Nov. 19; six months.

John Buchanan, of Ramsbottom, Lancaster, millwright, for an improved apparatus for the purpose of dyeing, and performing similar operations. Nov. 22; six months.

Thomas Robson, of Park-road, Dalston, Middlesex, operative chemist, for improvements in firing signal and other lights. Nov. 22; six months.

George Guynne, of Holborn, gentleman, and James Young, Brewer, of Brick-lane, for improvements in the manufacture of sugars. Nov. 22; six months.

Isaac Naylor, of Stainbrough, near Barnsley, York, gamekeeper, for an alarm-gun or reporter and detector. Nov. 22; two months.

Timothy Hackworth, of New Shildon, near Bishop Auckland, engineer, for improvements in steam-engines. Nov. 22; six months.

Thomas Ellis, of Stamford-hill, Middlesex, Esq., and Thomas Burr, of Shrewsbury, Shropshire, for improvements in the manufacture of sheets and pipes or tubes, and other articles of lead and other metal. Nov. 24; six months.

Joseph Woollams, of Wells, Somerset, gentleman, for certain improved means of obtaining power and motion from known sources. Nov. 24; six months.

LIST OF SCOTCH PATENTS, GRANTED BETWEEN THE 22ND OF OCTOBER AND 22ND OF NOVEMBER, 1836, INCLUSIVE.

Thomas Grahame, of Nantes, France, but now of St. James's-street, Middlesex, gentleman, for certain improvements in passing boats and other bodies from one level to another. Sealed Oct. 25.

William Brindley, of Caroline-street, Birmingham, paper-manufacturer, for improvements in the manufacture of tea-tray and other japanned ware, and in the board or material used therein, and for other purposes. Oct. 26.

Michael Linning, Clerk to his Majesty's Signet in Scotland, for certain improvements in converting mosses into fuel, and in preparing and drying the said mosses, and for making and extracting certain colouring matter or paint, and tar, gas, oil, ammonia, varnish, and other properties from the same. Oct. 29.

George Sullivan, of Morley's Hotel, Charing-cross, Middlesex, gentleman, in consequence of a communication made to him by a certain foreigner residing abroad, and invention by himself, of improvements in machinery for measuring fluids. Nov. 18.

Robert Walter Swinburne, of South Shields, Durham, agent, for certain improvements in the manufacture of plate-glass. Nov. 18.

Augustus Applegath, of Crayford, Kent, calico-printer, for certain improvements in printing calico and other fabrics. Nov. 18.

John Yule, of Sauchiehall street, Glasgow, practical engineer, for improvements in rotary-engines, or an improved rotary-engine. Nov. 18.

NOTES AND NOTICES.

The British Museum.—Two Italian workmen have been lately busily employed in the Elgin Gallery, taking casts from the valuable remains placed there. The casts are made in a tenacious composition, resembling a mixture of wax and putty, but the most jealous care is taken by the Italians to prevent either the mode or the material employed in taking the casts being discovered, for each workman is surrounded by a canvas screen, effectually precluding the possibility of a glimpse. In a small apartment on the left of the principal gallery of sculptures there have been lately placed upwards of 200 specimens of the most beautiful Etruscan vases, the last Government purchase; the delicacy and finish of these matchless specimens of pictile art baffle description. They vary in size from the small but elegant vessel of two inches, to the magnificent amphora of three feet in height. Two or three splendid mummies, purchased by the Government about six months since at the sale of the unequalled collection made by Mr. Salt (his Majesty's late Consul at Cairo), have been placed in one of the small rooms, on the same floor with the gallery. Judging from the external decorations of the cases, they contain the bodies of early princes of Egypt. The fingers of the carved figure, representing the inhabitant within, are covered with valuable gold and other rings; some of these are cornelian, and bear curious characters, the signet of the deceased. Within the last twelve months the Library has received many valuable additions. A whole range of book-shelves in the first reading-rooms has been set apart for the reception of the newspapers of the United Kingdom; these have been mounted in rich bindings, gilt and lettered on the back, and present to the eye a brilliant array of literature, which might be taken for the richest editions of Piranesi and other folio authors. It is not generally known, that some of the most skilful bookbinders in London are constantly employed within the walls of the Museum, putting into substantial bindings the purchased and presentation copies of all literary works in boards. Some rare specimens of binding are found in the King's Library, which serve as models to the mechanics employed. The choicest specimens of binding in the library just named are by Roger Payne, a worthless creature, who has received as much as 200 guineas for binding a single folio work; and though constantly employed (when he chose to work) died a beggar, upwards of 100 years ago. The department of MSS. has also been considerably enriched during the past season, not only by the accession of the Arundel manuscripts, purchased from the Royal Society at Somerset House, but also by the acquisition of 58 volumes of Oriental manuscripts, purchased from the same Society for the comparatively small sum of 16*l*. It may be added, that within the last few weeks a green basalt sarcophagus (which still remains unpacked) was presented by the Duke of Hamilton.—*Standard.*

The Supplement to Vol. XXV., containing Title, Table of Contents, Index, and Plate of Specimens of English Medallic Engraving by Mr. Bate, will be published on the 1st of December next, price 6d.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

A complete list of Patents from the earliest period (15 Car. II. 1675,) to the present time may be examined. Fee 2s. 6d.; Clients, gratis.

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COLLIER'S PATENT STEAM-BOILERS, AND SAFETY BREATHING-TUBE.

Fig. 1.

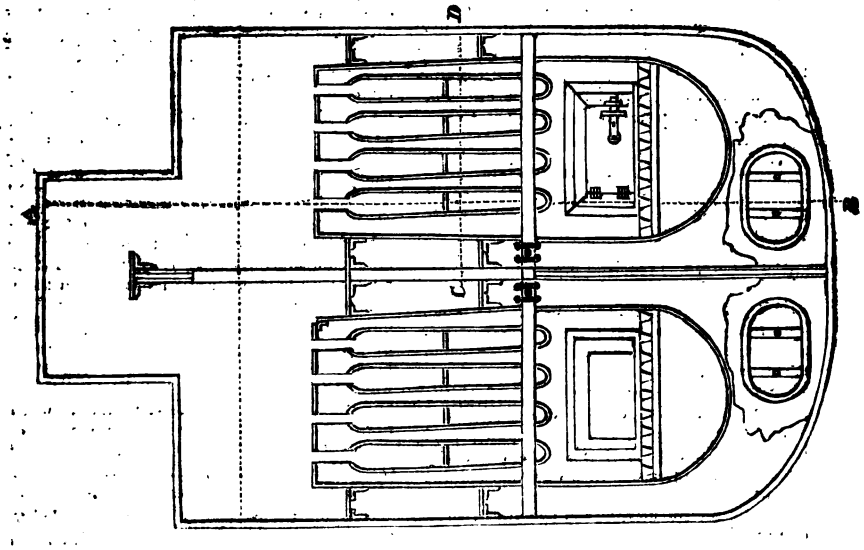
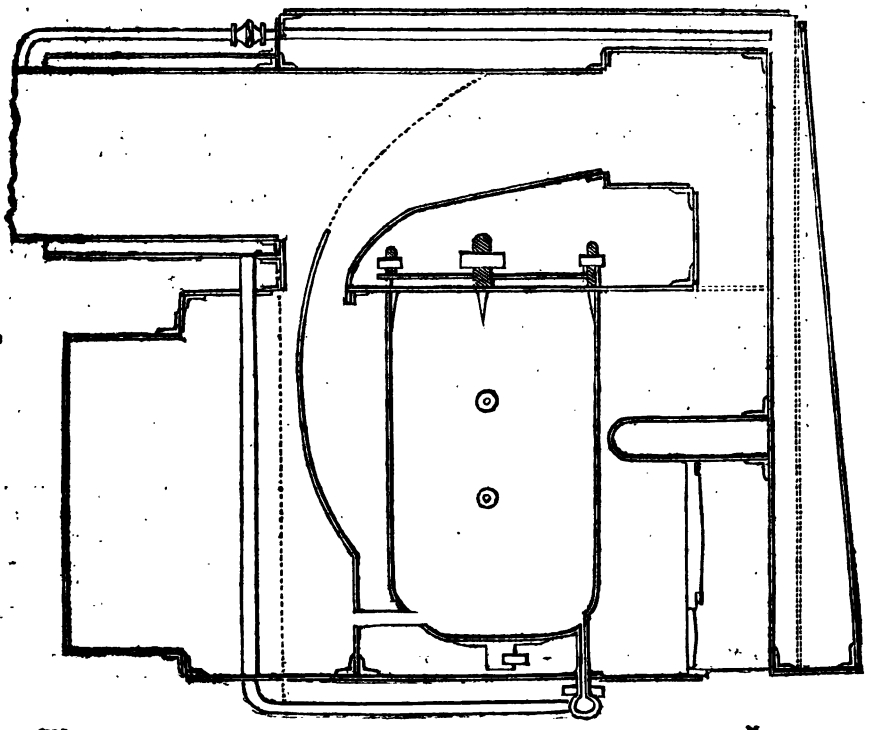


Fig. 2.



COLLIER'S PATENT STEAM-BOILERS AND SAFETY BREATHING-TUBE.*

In the year 1831 Mr. Collier obtained a patent for an improvement in steam-boilers. In 1835 the Lords of the Admiralty were induced to give the invention a trial, and the inventor a chance, of proving by practice his theory to be correct.

From a pamphlet which has been published upon the subject, we extract the following particulars of the experiments:—

"He (Mr. C.) received orders to fit a pair of one-hundred horse power boilers, in his Majesty's ship the *Meteor*, which was done. The first trial to prove their power of generating steam was made in still water, when eighteen revolutions of the paddle-wheels were made, those of another vessel of the same power making only eleven revolutions. When ready for sea, the *Meteor* was placed in competition with the steam made by another vessel; a distance was marked out upon the river, and due observations taken, when the *Meteor* was proved to gain in speed one and half knots per hour, by the working of the patent steam-boilers of Collier's invention. Thus establishing their working powers. Another trial was made against H. M.'s vessel *Firebrand*, from Woolwich to Sheerness; four Lords of the Admiralty were in the *Meteor* to witness this trial. The *Meteor*, furnished with Collier's patent boilers, beat the *Firebrand* by twenty minutes, in this short distance!! The *Meteor* had also a trial to run against H. M.'s ship, the *African*, from Plymouth to Falmouth, a distance of fifty-five miles, when she gained an hour and half in speed during that short run, *with Collier's patent boilers*.

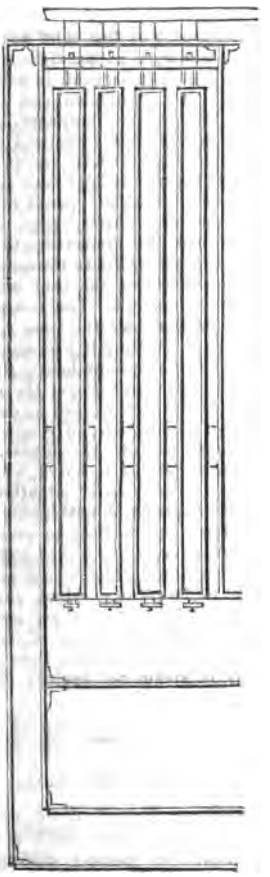
"The *Meteor* was then ordered to Lisbon, and Mr. Collier was directed to attend the voyage, as soon as fuel and other requisites could be provided; but here, a great disadvantage presented itself, by reason, that only Welsh coals could be obtained, and even those of a very bad quality, instead of Newcastle coals, yet, with these she put to sea, working admirably; and, notwithstanding that the *Meteor* was overtaken by a violent tempest, and obliged to lay to for twenty-four hours, and during which period the fires were banked down, and the steam let off. On the abatement of the storm, the pilot ordered Collier to prepare for work (presuming, as in ordinary cases, that an hour or two would be required to get up the steam to the working power). Mr. Collier immediately superintended his fires, and in less than *ten minutes* his steam was up to the working point; on intimating which to the pilot, he would not believe it possible; but however, found it to be *the fact;* this being a further evidence of the power of these boilers (notwithstanding the inferiority of the fuel, a large quantity of which, indeed, was so bad, that it was thrown overboard). However, the voyage proceeded, to the admiration of all on board; * * * the stokers declaring that they would rather stoke these boilers for six months than those in present use for one month. No flues required cleaning during the voyages out and home. With equal success the voyage was performed back from Lisbon to Falmouth, where the boilers were scrupulously examined, and were found to be quite as perfect as when first put on board, and without an atom of *sediment* from the impurities of the water, or *crystallisation of salt;* thus proving another of the great merits of these boilers.

"Upon these reports being forwarded to their Lordships, an order was forthwith given for the payment of the price agreed upon for these boilers."

Notwithstanding these favourable reports of their "*faithful* servants," the public will be surprised to learn (and we wonder Mr. Collier does not inform them how and why it so happened) that the Lords of the Admiralty ordered Mr. Collier's boiler to be removed, and the *Meteor* to be placed out of commission till she could be refitted with boilers on the common plan. The price Mr. Collier received for his boiler was 2000*l.*; and so highly did their Lordships value it, that Mr. Collier was allowed to repurchase it at the price of old metal. The sum for which it was appraised back to him (funnel included) was 150*l.* (!) being at the rate of 4*l.* 10*s.* per ton. We are, however, too well aware of the nature of Admiralty dicta to place implicit reliance upon the decision of their Lordships; and as Mr. Collier has lately been "blowing off" a good deal of *vapour*, in the shape of advertisements and paragraphs, "particularly inviting" engineers and boiler-makers to examine his important improvements, we have thought that his own exposition of the "superior advantages" thereof would be interesting to

* On the Superior Advantages of the Patent Improved Steam-boilers, invented by Elisha Haydon Collier, Civil-engineer. London: John Nichols, Chandos-street, West Strand.

Fig. 3.



the scientific public—from the before referred to pamphlet. We cannot compliment the writer upon the correctness or elegance of his diction; but this does not, of course, detract from the merits of the invention, whatever they may be, and which we must leave our readers to discover—for, to speak the honest truth, we can ourselves perceive none other than a little ingeniously-arranged complication, and consequent increase of expense. We fear Mr. Collier will not make many such good bargains as he did with the Lords of the Admiralty.

"A low temperature is best adapted for these boilers; thus showing that there must necessarily follow a saving of fuel—for it is not the lavish supply of coal, but the judicious application of it, that produces the temperature required. The peculiar structure of these boilers, they being surrounded with a jacket of iron, and between which and the boiler lies an intervening slow-conducting medium, prevents all radiation of the heat, so much so, that the hand may be put on the boiler without experiencing the least inconvenience, thus securing comfort to the passengers against the oppressive heat of the boilers now in use, and also the preservation of the goods, which may now be stowed close to these boilers. The *multum in parvo* of these boilers is, in the present state of navigation, the greatest desideratum; for, when you take a comparative view of the patent boiler only occupying *ten feet* for a 100-horse power, whilst those in present use occupy *twenty-four feet*; and thus obtaining fourteen feet of length in the principal part of a ship, in the entire section, and employing this great space either for stowage, or the accommodation for passengers, by enlarged saloons: but a saving also of at least fifty tons in weight, as in these patent boilers, on account of their diminished size, so much less water is required. These objects combined will naturally show that a great saving of fuel must follow of course.

"*Description of the Boiler.*

"In the annexed engraving (see front cut), fig. 1, is a front section of a steam-boiler, with part of the front plate removed, the right-hand side showing the furnace-doors, while those on the left are removed; and below the ash-pits two covers of the apparatus, for occasionally cleaning out any mud or sediment, are shown; they being placed at the lowest part of the boilers, where all the deposit will naturally be lodged.

"Fig. 2 is a side section or elevation of the boiler, taken at the line A B, of fig. 1. Fig. 3 is a plan of one-half of fig. 1, taken at the line C D of that figure.

"In this steam-boiler the water is divided amongst a number of narrow upright chambers, with spaces between and around them, for the flame and heated air from the furnaces to pass through, and thus quickly to heat the water; their back-ends all opening into one common cross-chamber. These chambers being nearly closed at their tops, the steam generated ascends and escapes at

the upper part of their back ends, whilst the water is constantly flowing in at their lower parts, and thus a circulation is produced which effectually prevents any sediment being lodged within the chambers. These chambers are placed in separate furnaces and the whole is enclosed in one casing' forming the steam-boiler; the chambers,' ash-pits, and the whole furnaces, being enclosed, and surrounded by water. There is likewise provided an outer casing (not shown), containing a slow-conducting medium, to prevent the radiation of heat, as above-mentioned. The flue is likewise surrounded with water, to become heated, and to supply the boiler, in proportion to the evaporation, occasioned by the escape of the steam; this supply is effected by an upright pipe, proceeding from the water around the funnel, and connected with a horizontal pipe, from which branch-pipes enter at the bottoms of all the chambers, and thereby prevent the possibility, however violent the fire may be, of the water being removed from contact with the interiors of the chambers; the pressure of the column of water being much greater than the pressure of the steam. There are likewise provided vent-pipes, at the upper front ends of the chambers, to allow the escape of any surplus steam that may be generated in the chambers, to the mass of steam contained in the steam-chest. These two last improvements effectually prevent all injury to the steam-generators or chambers, from any carelessness or wilful design to injure them by over firing.

"In fig. 2 an upright pipe or tube is represented, which is opened at both ends; the lower end being immersed within six inches of the bottom of the boiler; and the upper end entering the funnel; and thus, in case of any accident arising from the sticking of the valves, or other causes, the pressure of the steam in the boiler will force the water into the funnel, and extinguish the fire; and *vice versa* in case of a collapse, from any sudden condensation of the steam, the upper end of the pipe being open, will admit the atmospheric air to enter and restore the equilibrium. And it is a known fact, that a boiler of any description, as a common house copper, or a tea-kettle, for instance, have never been known to burst, either by expansion or collapsing; as, notwithstanding all the gases which may be generated, from the oxygenation of the metal by the water, the pressure of the atmosphere keeps the water in constant contact with the metal, and prevents it from being overheated, which is the general cause of the bursting of all boilers.

"The cause of steam-boilers exploding is but little known; but it generally arises from the prodigious expansion of the gases, produced by the decomposition of the water by the heat. This mischief, however, will be entirely prevented by the introduction of this beautifully simple invention, '*the safety or breathing-pipes.*'

"A summary of the chief advantages of these patent improved steam-boilers:—there is a saving of fifty per cent. in weight, room, and fuel; no incrustation can take place therein, from salt or sediment, and consequently, the boilers are rendered more durable; and as no heat can radiate from the boilers, so the ship is kept cool throughout, and the comfort of the passengers and live stock promoted; butter, eggs, and other provisions will be preserved; there is no danger from setting fire to the coals or cargo, and in consequence, the rate of insurance ought to be reduced. The steam is got up in less than one half the time required by the ordinary boilers; if necessary to bank the fires for twenty-four hours, five minutes time is only necessary to get the steam up; as these boilers are worked under an open column of atmosphere, of course they can never either explode or collapse. Repairs can be easily effected on board, with as much facility as in any other situation, thereby saving the expenses of unshipping and shipping. There are no flues to sweep in case of long voyages, spare sets of chambers can be taken on board; the boilers are supplied with hot feeding-water, which causes a saving of from ten to fifteen per cent. in fuel. Boilers upon this principle of only ten feet in length, will generate more than a sufficient quantity of steam for engines of one hundred horse-power."

DEFECTIVE VISION.

Sir,—I am one of those unfortunate individuals who have such a defect of vision that they cannot distinguish one colour from another; and having been brought up to the profession of an artist, you may imagine it is a source of great inconvenience to me, being obliged to take the greatest care that I place the colours I require in such situations that I shall not make mistakes. Hitherto I have succeeded very well, by dint of close study and great care, in colouring without this defect being known. I have endeavoured to become master of most of the theories on harmonious colouring; but still I gain very little in the actual distinctions of colours. Perhaps there

may be some system by which I might be able to gain the knowledge I am now seeking; and either you, or some of your readers, may be induced to make such system public by means of your valuable Magazine, which would be of the greatest benefit to many individuals labouring under the same disadvantage.

I am, Sir,
Your most obedient servant,
W.

Manchester, Nov. 19, 1836.

EVIDENCE TAKEN BEFORE THE SELECT COMMITTEE APPOINTED TO INQUIRE INTO THE BEST MEANS OF EXTENDING A KNOWLEDGE OF THE ARTS AND OF THE PRINCIPLES OF DESIGN AMONG THE PEOPLE (ESPECIALLY THE MANUFACTURING POPULATION) OF THE COUNTRY; ALSO TO INQUIRE INTO THE CONSTITUTION, MANAGEMENT, AND EFFECTS OF INSTITUTIONS CONNECTED WITH THE ARTS.

(Continued from page 157.)

Questions answered by Baron Von Klenze, Architect and Privy-Councillor to his Majesty the King of Bavaria.—(Translated from the French.)

How many schools of design are there in Bavaria?—there are in Bavaria thirty-three schools in which drawing is an essential part. In every school with us, in fact in every village school, drawing is taught. There are at this moment thirty-three real schools of design established; there are thirty secondary schools for artisans, called "Gewerbschulen," and three primary or polytechnic schools.

Is design a part of national education?—An integral part.

What is the course adopted in teaching design as a part of national education?—I think the best way will be to explain all the course. Every school among us has a class of design, even in the smallest villages. When they leave the schools, if any of the scholars wishes to devote himself to any particular branch of art, then he enters in one of the thirty secondary schools which I have mentioned. In those secondary schools instruction is given to all those who are to be devoted to the arts and to manufactures, to civil engineering, to architecture, to roads and bridges, and even to agriculture, because there are schools of agriculture, and to waters and forests. In those secondary schools they remain three years; after those three years are expired, the young people determine what branch they will embrace, as I have just said, and then they enter the polytechnic schools, and there they finish their education.

When they enter the polytechnic schools, is it necessary to devote themselves to some profession?—Yes; that is to say, they are not exactly obliged to do so, but the instruction is divided there into different branches. For example, there is a chair for the waters and forests, a chair for the architecture, a chair for manufactures, for physic, &c., and for the mines, and, in short, for every branch.

Then, when they enter the polytechnic schools, the students are distributed according to the profession which each one chooses?—Yes.

In the primary schools, in what manner are the pupils instructed in design?—In the primary schools they are instructed in linear drawing, both in free drawing with the hand and in geometrical drawing. In those schools they only learn to draw in outline, triangles and every kind of perspective, and the simple element of ornaments, but only in outline. Every species of embellishment as to drawing is strictly prohibited in the primary schools.

Then all the children in Bavaria have an education in linear drawing?—If they wish. In the primary schools they are asked whether they will learn design; and if they will, it is done; but if they will not, it is not forced.

But generally they all learn it?—Almost all of them; but they are not compelled.

Are they compelled to receive general education?—No, they are not forced; it is not at all necessary; they all do it voluntarily. But when they enter the secondary schools, where the arts and manufactures are taught, there they are obliged to learn the art which they have adopted.

Up to what point do the schools of design go?—They ascend from the primary schools to the secondary schools, and there we have adopted the principle of making them continue as long as possible to learn outline; they make them study form very strictly in those schools; they go so far as to enable them to do many things very difficult, to design architecture very correctly, and such things, and then they begin modelling. Then the last are the polytechnic schools, of which there are three. Before they arrive at the polytechnic schools all who wish to devote themselves to trade diverge to those pursuits, and those who wish to devote themselves to the higher branches of engineering, enter the polytechnic schools. In the polytechnic school they are instructed in all that relates to engineering, architecture, the waters and forests and the mines; all that is comple-

taught. They learn to model and to form all the designs in so complete a manner that they are not surpassed by any, except by those who are professionally sculptors and painters, and who go still further in studying those branches, and they enter the academy where their education is completed.

You are understood to say that all the artists of Bavaria receive a previous scientific education?—Yes; but besides that they are receiving at the same time a classical education in the polytechnic schools. In the primary schools they learn only German; in the secondary schools, French, history, geography, natural philosophy, chemistry; all that instruction goes on at the same time with drawing, and all who pass an examination in architecture, or any branch of design, must be acquainted with Latin and Greek to a certain point.

Are there not a number of celebrated artists in Bavaria who have not received this education?—There are, because this is only a recent system, and hardly any living artist of any distinction has followed this course of education, except by following his own inclination at his own expense, or that of his friends. In Germany they are more regular in the course of education they pursue, and therefore some artists of their own accord have followed this system even now; but, hereafter, all who wish to obtain an employment by Government must have gone through this course of education, newly organised by the present King, who is a great promoter of fine arts.

Have you any institution in Bavaria such as the Gewerbe Institute in Berlin?—No; in our secondary schools they receive an education in the arts of manufacture, but not to so great an extent as at the institution in Berlin.

The Gewerbe Institute at Berlin is an institution for the manufactures as well as for the arts, that is where the arts and manufactures are united to form manufacturing artists?—Yes.

Do you think that the Gewerbe Institute at Berlin is the best institution of that kind on the Continent?—Certainly.

For the purpose of instructing a manufacturer in the arts, is not it necessary that the artist manufacturer should study the peculiar manufacture to which he is going to devote himself as well as the arts?—Certainly.

It is not enough to be an artist, but he must also be a manufacturer?—Certainly.

You must entirely unite the trade with the art?—Yes.

Among the higher classes in the gymnasia and in the universities, do they receive any instruction in art?—No; those who wish to cultivate those tastes take private instruction.

Are the richer and higher classes in Bavaria generally well instructed in design, or is it generally neglected in their education?—They are generally instructed in it; they have a general knowledge of design.

Does the Bavarian government publish works for the instruction of the people in these branches?—At present it has not published any, but there is an ordinance to that effect.

Do you know the works published at Berlin by Monsieur Beuth?—Yes.

You have not such works in Bavaria?—We have none such at present. There are some such works published by private individuals, but not by the government.

Do you think it would be an advantage to the people, especially to the manufacturers, that the government should publish such works?—A very great advantage.

Especially such works as those which are published at Berlin, which are so expensive that an individual could scarcely undertake them?—Certainly.

You think it would be of great advantage to manufacturers?—A very great advantage. Since that work has been published at Berlin, wherever you go lately, you see every where in the shops the influence of that work; it has done a great deal of good.

In Bavaria you are going to imitate the example of Prussia in that respect?—Yes, but not on so expensive a scale.

It is necessary that such a work should be drawn with the utmost correctness?—Certainly, you must employ the first artists.

And consequently the government must undertake it and not a private individual?—Yes; at present every thing is done by private individuals. I have myself published a work of "Greek ornaments," but it is always difficult; it costs a great deal, and therefore it is necessary that it should be done by the government.

Besides the government work issued by Mr. Beuth, what are the best works containing specimens for manufacturing artists in Germany?—One of the best works is the work of Mr. Zahn, of Berlin, published in 1831; it is the ornaments of all classical epochs of art—"Ornamente aller classischen Kunstepochen nach den Originalen."

Have you ever turned your attention to the advantages and disadvantages of academies?—In the countries where the fine arts are not much promoted by the government or the public, there I think academies are useful and advantageous as schools of art; but where the arts are much practised they are of less value.

Do you think that the academy ought to be merely a school for instruction in the arts? No, it ought to have a double end; to be a school and to extend the arts and sciences. I think, besides giving instruction, it may

be also an institution as in the case of the Institute of France, for the promulgation of the arts in general, and where the government may obtain any information with respect to the arts which it requires, from the men of science who are collected together there. With us, if any question of science arises, it is referred to those academies for their decision.

Has public opinion much influence upon the election of the academicians?—Not directly, but indirectly it has; the men who are most celebrated among the public for their attainments are generally chosen by the academicians.

With respect to galleries; will you have the goodness to state to the Committee your ideas with respect to the construction of a good gallery, and the arrangement of the pictures and statues?—In the galleries at Munich, of which I was the architect, I thought it was essential to separate the statues and the pictures, because the one and the other are so different in the light, and so on, that they require, that it is difficult to unite them in the same building, without sacrificing the one to the other. For the gallery of sculpture, I thought it was desirable to arrange them historically. There were two modes of arrangement hitherto pursued; the one the mythological or ideal, and the other the historical. I thought it right to follow the historical plan. I began with the Egyptian the first, because the Greek art sprang from the Egyptian. Then after the Egyptian room, the hall for the ancient Greek or Archaiic sculpture, which is the second room. The third room is the school of Egina; here we have the famous Egina marbles. Next comes the room for the school and the times of Phidias. Then come two rooms for the most beautiful Greek epochs; after that there are three rooms, in which there are no statues, but they are richly painted in fresco, representing the history of the ancient gods and heroes, to refresh the eye after having seen the statues, by the sight of colours again. After those rooms begins the second gallery of sculpture; it begins in a room in which there are heroes and other celebrated persons. Here we begin the Roman art: two very large rooms contain the Roman art. Then we come to the last room, in which are placed some modern statues, since the "*renaissance*" to our times, in order to show how ancient art has entered into modern art. With respect to the collocation of the statues, my object has been to light them all from *one side only;* and the principle on which I have differed from all the museums hitherto constructed, is, in the employing of colour as a ground for the statues, instead of a dirty gray wall. I have put the deepest and richest colours, so that all the statues have the appearance of being quite new and fresh, in consequence of being relieved by the depth of the back ground. The ceilings also are very rich, being decorated with gilded stucco. The floors are also very ornamental. In showing the works of antiquity, you must not hesitate to show them in contrast with richness of colour. In the Roman hall, where the sculptures are all of deep coloured marble, the walls, on the contrary, are of a light colour.

Will you have the goodness to describe the construction and arrangement of the gallery of paintings?—The gallery of paintings (or pinacotheca) is destined to receive all those objects of art which are represented upon a plain surface; that is, those which have no relief, such as pictures, drawings, engravings, enamels, glass paintings, mosaics, &c. The first floor contains the pictures, and the entrance floor contains the other objects. With respect to the pictures, this is the system which has been adopted:—They are placed according to the schools. I wished to allow the possibility of arriving at any particular school without going through another, and for this purpose I have a corridor running the whole length of the building, which communicates with each separate room. The large pictures are in very large rooms, lighted from above; the smaller pictures are in small rooms, lighted with a side light from the north; such is the general disposition. The rooms are so arranged that the spectator is not annoyed by reflected lights; but wherever he stands he sees the pictures without any reflection. With regard to the classing of the pictures, there is first a large ante-chamber, which is extremely richly ornamented, but only with white and gold; no colour. It is ornamented with six large pictures, portraits of the founders of the gallery. There is a room attached for restoring pictures and for copying, upon a special permission being given to take down a picture from the walls of the gallery for that purpose; it serves also for the exhibition of pictures newly purchased. The first large room is for the ancient Flemish school, with three smaller rooms attached for the smaller pictures; after that a great room for the ancient German school, with four small rooms; then three large rooms for the more recent Flemish school, with ten small rooms; then a room for the French and Spanish school, and then three large rooms, one of which is 93 feet long, for the Italian school, and three small rooms for the smaller pictures. Then there are some rooms attached for the subordinate purposes of the gallery. Then, on the entrance floor, there is a gallery for engravings; one for original drawings of the great masters; there is a considerable space for ancient paintings; such as the ancient terra cotta vases, mosaic;

and the other rooms are for paintings executed by means of fire; such as glass, porcelain, enamels, &c.

What is the greatest height of your rooms in the gallery of paintings; what is the height and width of the largest picture they would contain in English feet?—The rooms of the principal floor are 52 feet high to the top of the vaulted ceiling, 31½ feet to the springing. The width 42 feet. The principle upon which the several dimensions were regulated, in consultation with the director of the gallery, was this:—All the pictures are fixed upright against the wall, not sloping. The highest point at which the top of the largest pictures should be placed was assumed to be 29 feet, the lowest 4 feet. The shortest distance from which it should be seen 25 feet.

Does any person reside in the building?—No person is allowed to reside in the building for fear of fire.

Is the building fire-proof?—It is entirely fire-proof. All this gallery is heated with warm air, in order to preserve the pictures from humidity, which is very essential for the preservation of the paintings, and more particularly in such a climate as this of England.

Should the temperature be always the same?—As much as possible; in winter the temperature should never be less than ten degrees of Reaumur.

Have you not also several provincial galleries in Bavaria?—Yes; we have three at present, at Augsburgh, Nuremberg and Schleissheim, and they are going to establish several others in other principal towns.

All those galleries are open to the public without any payment?—Yes, it is open to every body. It is most expressly prohibited to take the least payment.

Do you think it is desirable in a picture gallery to put over the different schools the name of the school, and upon each picture the name of the painter and the time when he was born and died, and perhaps the name of his master?—Certainly.

Have you also a catalogue raisonné?—We have; that is quite necessary.

Have not you in Bavaria what is called Kunst-vrreinse, or associations which purchase works of art, and dispose of them by lottery to the contributers of the lottery?—We have. Those galleries are open all the year round, and they act as a very great encouragement to art in that branch which does not receive the patronage of the Government, which is of course confined to pictures of the highest class.

SUGGESTIONS ON AERIAL LOCOMOTION.

Sir,—It is remarkable, that while the art of *directing* balloons is acknowledged to be such a desideratum, that so few experiments have been tried towards effecting it.

To attach oars or wings to the car must be inefficient, because the balloon *draws* the car (as well as keeps it up), and not the car the balloon. All the propelling power, therefore, that can be thus gained, will be uselessly expended, as the car will never get a-head of the balloon.

I would propose, then, that two light and ample wings be connected with the balloon to a strong hoop, with valves admitting the passage of the air in their backward motion. Two poles or bow-sprits can be projected "fore" and "aft" of the car, with pulleys at the ends; and by two ropes fastened to the wings near the hoop, and running through the pulleys, a reciprocating action can be produced, which will enable the balloon to move with a somewhat greater celerity than the current, and in proportion to the *relative* speed thus gained, will be the advantage derivable from the rudder.

Nature is generally the best guide. It may be desirable to keep in view the action of a bird, remembering that art gives us an advantage, by rendering unnecessary the immense muscular power required to keep the bird buoyant, the gas answering that purpose.

To oppose the wind, of course, will ever be impracticable; but I doubt not that a few trials will suffice to adapt the principle already unsuccessfully attempted, to the purpose so generally desired, so far as to allow of a deviation of one or two points from the wind's direct course.

The mode adverted to by a former correspondent, of connecting birds with the balloon, appears to me well worth experiment. If attached to the frame in such a way that they *must fly* in *one* direction, that direction would of course be regulated by the rudder, and training rendered needless. I wish Mr. Green or Mr. Graham would avail himself of the opportunity which the liberal proprietors of the Zoological Gardens would doubtless present them with, of borrowing a few eagles to try it partially. The balloon, however, not the car, must be primarily drawn.

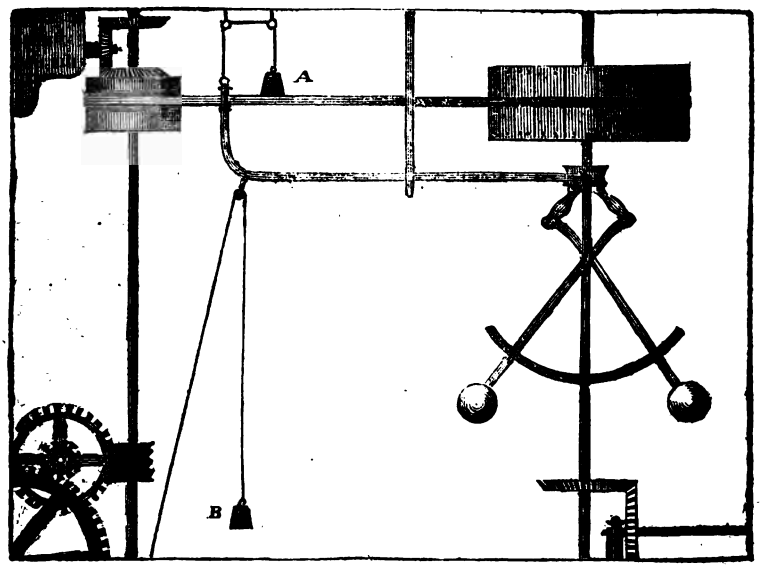
I am, Sir,

Yours respectfully,

WM. RANWELL.

Woolwich, Nov. 22, 1836.

IMPROVED WATER-WHEEL GOVERNOR.



Sir,—With this you will receive a drawing representing an improvement in the water-wheel governor, which, having tried and found it to answer, I can confidently recommend for the adoption of such of your readers as may have the superintendence of water-wheels where a steady and uniform motion is required. The difficulty of making a water-wheel governor to act well, is known only to those who have, in the course of their business, been called upon to fix one to a wheel where an irregular action is a necessary consequence, from the nature of the work which the wheel has to perform. But, independent of any irregularity in the resistance which the wheel has to overcome, the wheel itself is extremely liable to get out of balance from the unequal absorption of water by the different parts, and other causes, which renders it extremely difficult to adjust the governor, so that the machinery shall work with a uniform motion. To obviate this difficulty, I introduced the counter-weight and bridles, marked A and B in the drawing, which entirely neutralizes the evil effects produced by small and unavoidable inequalities in the balance of the wheel, arising from the unequal absorption of water by the different parts. So decided an effect was produced by this small improvement, that for upwards of two years the governor maintained a uniform command upon the velocity of the wheel without requiring any adjustment whatever; and I have been informed, that this plan has been adopted at several manufactories in the west of England. When any portion of the resistance is removed from the wheel, the governor acts as in ordinary cases, whilst, at the same time, the improvement here recommended checks the evil arising from small irregularities.—Yours, &c.

HYDRAULICUS.

ACTUAL DISTANCE TRAVELLED BY MR. GREEN'S GREAT BALLOON IN ITS LATE CONTINENTAL TRIP.

Sir,—Being curious in wishing to get the precise distance the great balloon travelled in its late Continental trip—at my request, a friend (actuary of the Savings'

Bank here) kindly gave me the enclosed, as the result, supposing it had descended at Nassau; and it is much at your disposal from your constant reader,

RICHARD EVANS.

8, Castle-street, Swansea, Nov. 9, 1836.

To	7° 52′ E. long.	From	51° 31′ N. lat.
Add	5 W.	Take	50° 16
Sum	7° 57	Diff.	1° 15
	60		60
	477 miles diff. long.		75 miles diff. lat.

Then $\sqrt{477^2 + 75^2} = \sqrt{233154} = 482{\cdot}86$ miles, the distance.

The above is calculated on a plane. The difference would be very little had the calculation been according to Mercator, since the longitude alone is 477 miles.

THE MECHANICS' ALMANAC FOR 1837.

In our last year's notice of this almanac we were induced to recommend it strongly to the attention of our readers, from a conviction of its peculiar adaptation to engineers and mechanics—to every person, in fact, in any way connected with mechanical or engineering operations. As every thing connected with the advancement of mechanical science claims our special attention—so, in like manner, wherever we perceive a disposition, as in the present case, to recognise the important station which the mechanic holds in the body politic, we are at all times ready to concede our meed of approbation, cheerfully and cordially. That the present wealth, greatness, and political *status* of England, is to be attributed to the pre-eminent skill and industry of her artisans and mechanics, is as plain and incontrovertible as any axiom in Euclid. The Inventors of Britain—these are the true nobles of the land, the best benefactors of their country. "Nelson and the Nile"—"Wellington and Waterloo"—may be sounds agreeable enough to martial ears; but to those who delight to cultivate the arts of social life, who rejoice in the contemplation of whatever adds to our store of pure and peaceful enjoyments, "Watt and the Steam-Engine"—"Arkwright and the Spinning-Machine"—are associations that will ever recur to their minds with much deeper and livelier feelings of gratitude and veneration. The engineers and mechanics are the true bones and sinews of the nation. As a body, they are possessed of a larger amount of sound, practical, and productive knowledge, than any other body of men in the whole world. And to revert to our more immediate theme—the *Mechanics' Almanac*—we would say, as the highest praise we can bestow, that it is in every respect worthy of the body to whom it is addressed.

A simple enumeration of its principal contents will show that this is not unmerited commendation. Opposite to the usual calendar pages (in which the times of the sun's rising and setting for every day are given, as shown by a well-regulated clock or watch, and not according to solar time as before—a judicious change) there are historical and biographical reminiscences of each month, culled principally from the annals of invention and discovery, and likely to be of a most usefully suggestive character to the minds of mechanical readers. We quote an example or two:—

"3 (Jan.) 1795.—Josiah Wedgwood died, aged 65; born July, 1730; the great improver of the English pottery manufacture. "He converted a rude and inconsiderable manufacture into an elegant art, and an important part of national commerce. By these services to his country he acquired an ample fortune, which he blamelessly and reasonably enjoyed, and generously dispensed for the reward of merit and the relief of misfortune."

"28 (March) 1380.—Gunpowder is supposed to have been first used in Europe by the Venetians upon this day. About the time that printing was invented, by 'divine

inspiration,' says Rabellais, 'as a set-off against the Devil's suggestion of artillery.'

"9 (April) 1788.—The first threshing-machine ever in use was secured to Mr. Andrew Meikle, of Houston Mills, near Haddington, Scotland, its inventor, by Letters Patent of this date. Being at Kilbagie, the residence of a Mr. Stein, Mr. Meikle agreed to erect a threshing-machine for him, in which the grain was beaten out by the drum after passing through two rollers, used for drawing the grain into the machine. This machine was completed in February, 1786, and being found to answer its intended purpose with a few improvements, a patent was applied for, and, after considerable opposition, obtained."

Following these Reminiscences, we have Astronomical Phenomena of 1837—Explanation of the Equation of Time—Table of the Illuminated Portions of the Disks of Venus and Mars—Best Criterion of a Good Telescope—Evenings and Selections favourable or otherwise to Astronomical Observations—Powers of Telescopes necessary for Observing various Celestial Bodies—Note on the Satellites of Jupiter—Friendly Society Tables (an excellent selection from Mr. Ansell's valuable Treatise on Friendly Societies—Table showing the Proper Number of Turns or Twists to an Inch of Cotton Warp for every Degree of Fineness—New Patents granted in 1836—List of Patents which expired in 1836—Rules for Estimating Water-Power—Comparative Value of Building-Ground in and about London—Comparative Cost of Buildings (per Square) in London—Comparative Table of the different Modes of Expressing the Pressure of Steam—Table of the Weight of Plates of different Metals—List of Alloys, Solders, and Amalgams, used in the Arts—Tables of the Number of Woollen, Cotton, and Silk Manufactories in the United Kingdom, and of the Number of Hands they Employ—Table of the Number of Power-Looms in the United Kingdom; after which come various lists and tables not of so rare and peculiar a character as thr preceding, being such as are, more oe less, common to all almanacs—from tables of heads that wear crowns, to tables of heads that wear hair-powder—the number of which last, we are rather startled to observe, amounts, with all our improved notions of the *proper use* of heads, to no less than 10,512.)

The Family and Parochial Almanac for 1837.

This is an almanac which appeared (we believe) for the first time last year; and we rather take shame to ourselves for having allowed a year to go bye without giving it that hearty welcome which the usefulness of its purpose, and the good judgment with which that purpose has been worked out, deserved at our hands. Of the various *class* almanacs, into which the increasing intellectual wants of the community have caused this branch of the book-trade to be subdivided, this is, in our humble opinion, one of the very best. If we may except the *Mechanics'* (and perhaps our *mechanical* relationship does not qualify us to be the most impartial judges in the world of the merits of that particular production), it is by far the most *readable* annual of the kind. The articles in the present year's edition, intituled, On Making a Will—Hints for the Mistress of a Family—On Fires and Fire-Establishments—Miscellaneous Hints and Directions in Domestic and Rural Affairs—Parish—On the Means of Preventing Offences—Short Explanations of such Law Terms as occur in Newspapers—Causes of Bankruptcy—are all extremely germain to "Family and Parochial" matters, and well worth reading and remembering by every head of a family or parish. There is one article "on the British Constitution," in which a higher flight is attempted than in any of the others, but by no means with proportionate success. It seems to us, in fact, not only out of place, but not fitted for a good place any where. The writer thinks the genius of the British Constitution is penetrated by a repetition of the old dogma, that it is a balance of power resulting from the resolution of three different forces, the King, the Peers, and the People; whereas, the most enlightened of our recent constitutional writers are agreed in opinion, that this so long received dogma is but a plausible fiction, in direct opposition to experience and common sense, which are every moment bearing proud witness that in the scale of national interests, the influence of both Princes and Peers weigh, and ought to weigh, but as a feather against the Will of the People.

Whatever difference of opinion may exist amongst the witnesses examined as to the extent of the danger to be apprehended from fire caused by locomotive-engines upon railroads, the Committee are satisfied that, unless due precautions are systematically adopted, the danger would be considerable, not only in passing through towns amongst crowded houses, but also in respect to plantations, corn-fields, stack-yards, and agricultural buildings in general adjacent to the line of the railroad; and they have ascertained with satisfaction that the ingenuity of scientific men has already been extensively, and to a great degree successfully, applied to the discovery of the most effectual means of meeting the danger. It does not appear, however, that as yet any plan has been devised which could be described as being at once completely effectual, and at the same time not injurious to the operations of the engine. The Committee are consequently not prepared to recommend the legislative enforcement of any specific plan for that purpose; but they are of opinion that if every Railway Company were made answerable for any damage that may be done by fire in consequence of the use of locomotive-engines, and if the parties who may be so injured were enabled to obtain due compensation by a short and unexpensive process, the interests of the Company would necessarily lead them to take every precaution in their power, and to avail themselves of any invention which might tend to increase that security from fire which the public are entitled to expect from all bodies of railroad proprietors who seek from Parliament the means of effecting their objects.

The Committee recommend that the Chairman should introduce a Bill for that purpose into Parliament.

EXTRACTS FROM EVIDENCE.

George Rennie, Esq., C.E., examined.

I know only of two accidents having occurred from goods being fired. It was supposed the ashes tumbled out of the grate of the engine upon the railway, and that they were struck by the wheels, which struck the sparks into the waggons, and by those means they caught fire; but I never could learn whether that actually was the case. I am of opinion that protection from fire can be given by means of placing a hood or cylinder on the top of the funnel, and also by means of an efficient ash-box under the grate. I have brought a drawing which I will present to your Lordships. (*Mr. Rennie explains the drawing.*)

"*Description of the principal parts of the locomotive-engine.*

"A locomotive-engine may be divided into three principal parts; viz. the furnace or boiler, which generates the steam; the slides and cylinders, which bring it into action; the cranks and wheels, which transfer that action to the whole machinery.

"The minor parts which maintain the connexion have no reference to the present question.

"The furnace is situated in the hinder part of the engine, as represented on the drawing, and surrounded on every side by water, except at the bottom, in which the fire-bars are placed. The fuel is put into the side of the furnace.

"The boiler is divided into three compartments, separated from each other by partitions of plate-iron; viz. the furnace compartment, situated at the hinder part of the engine; the tube compartment in the middle, containing the water; the hot-air compartment, which supports the chimney, and contains the cylinders, steam, and blast-pipe. The upper part of the boiler, above the surface of the water, is appropriated to the steam-chamber and the steam-pipe. The fire-box is suspended to the bottom of the furnace with an interval or space between the upper edges for the admission of air to the furnace. The heat of the fuel should not exceed 1200 degrees Fahrenheit.

"The operation and power of the engine depend upon the magnitude of the furnace and number of tubes which produce the radient and communicative heat and consequent generation of steam.

"In the working of the engine the air rushes through the furnace, where it becomes heated, thence through the tubes into the hot-air chamber, whence it is carried up the chimney by the draught. This draught and consequent combustion of the fuel depend upon the vacuum created in the air-chamber and chimney; and as it has been found by experience that the draught is greatly increased by allowing steam, after it has performed its office in the cylinders, to rush up the chimney, it is usual to have an eduction or blast-pipe communicating with the two cylinders, and from thence to the chimney, so that the steam rushes out by the alternative operation of the pistons in the cylinders, thence into the chimney, where it creates a vacuum: the consequence has been a great augmentation to the power of the locomotive-engine.

"Previous to the introduction of the hood or cullender to the top of the chimney, the violence of the draught occasioned sparks to rush from the top of the chimney, and which is now obviated by the use of the hood."

The ash-box will suffice, without the ashes being emptied, for fifteen or twenty miles if necessary, but of course the steam is proportioned to the quantity of water; various contrivances have been resorted to prevent the sparks coming out of the top of the funnel; they have tried wire-gauze at the bottom of the funnel, but they found the distance between the meshes of the gauze was too large, the sparks got through; they then tried one at the top much on the same principle, still some sparks did get through; they then tried another, which merely consists of a series of wires placed in a spiral manner, held together by ribs, and strapped down to the centre of the chimney; the distance between the meshes is aoout the eighth of an inch, and consequently no spark greater than the eighth of an inch can get out; and from all I have seen, and all I have heard, I think it is the most effectual protection; I have never seen any sparks get out since that. I have seen it tried on the Liverpool and Manchester Railway, and on the Greenwich Railway. I attribute the last-mentioned cap being more effectual than the former to the meshes being smaller, and the obstruction to the going out of the steam, and the smoke less. There is more obstruction in the cross net, on account of the friction of the smoke against the angles, than in the spiral form. I think it is an exceedingly difficult thing to get any furnace to consume its own smoke; but where coke is burnt there is very little smoke, hardly any; I think that to prohibit any engines but those that do so, would be a very good restriction, as far as regards the metropolis; that those engines should not be allowed to burn coals. Supposing it were incumbent upon the person who had the management of the engine to reduce the heat upon entering a town, it would reduce the heat of the fuel and the liability to throw out sparks; and inasmuch as at the arrival at the depôt and the departure from the depôt, which are generally situated in towns, the engine moves with very moderate velocity, it is necessary to acquire the speed, which takes a considerable distance, and to slacken the speed, which also requires a considerable distance. I have no doubt that in a very short time the engines will be so improved as to prevent danger from sparks. Mr. Hancock, who travels on the high road, never suffers that inconvenience in his steam-carriage. I have a high opinion of the Llanelly coal; there is no smoke from it, nor sparks; it is rather dear, but it burns with an economy of about twenty-five per cent. over other coal; it will produce twenty-five per cent. of steam more than any other coal; but there is a difficulty in getting up the steam at first; it is a coal of a very peculiar nature, and requires a peculiar kind of furnace to burn it. There is an abundant supply, provided it could be brought to London. It is used in London in the Victualling-office in making biscuits; and a great many bakers use it; it would put an end to any danger in working the engines through the inhabited parts of London. The chimneys of locomotive-engines do not require much cleaning; there is not much soot comes from them; it is only where there are coals; but there is a great deal of sulphuric acid generated.

Dr. Lardner, LL.D., examined.

The only instances, I believe, in which fires have been actually produced have occurred on the Liverpool and Manchester Railway, and on the railway in Leicestershire, between Leicester and Swannington. On the Liverpool and Manchester Railway fires have once or twice been produced in the waggons, the cargo of the waggons has been burnt; but no fire has ever been produced on the Liverpool and Manchester Line off the road; no house has been burnt, or any thing of that sort, nor is there any apprehension entertained of such a result; it is merely the waggons. The circumstances under which those fires have occurred were these:—The fire was supposed to have fallen, indeed it did fall very much—cinders in livid combustion—from the fire-bars of the grate upon the road, falling within the rails, and sometimes scattered on the sides of narrow roads to a foot or two off the immediate line of the roads. The flange of the wheels narrows, which come down inside the wheels, almost touch the ground, and in many cases actually do touch the ground between the wheels, and when the fire gets close to the rail it is caught up and thrown up against the bottom of the waggons, the hinder wheels of each waggon; these throw the sparks into the following waggon. There was no evidence how the fire took place; the fact is that the cotton waggons were burnt, but this was the way it was presumed to have happened. The chimneys are roofed or hooded with wire gauze, through which no sparks of any magnitude could pass, and therefore it could not have arisen from that. Since that a remedy has been adopted which is strictly enforced, the fire-bars have been put closer together, so that no sparks of any magnitude can now fall through them; at least they would not do mischief; they would be immediately extinguished by the cold air; and since this arrangement of the fire-bars has taken place, no fires have taken place upon the road; and

I understand of the directors no apprehension is entertained from fire from this cause.

Did not you hear a report that a field of corn was set on fire?—Not on that road; there has been dry moss, which reached up close to the side of the railway, and therefore scorched by the engines: but on the Leicester and Swannington road, the dry corn was set fire to. The circumstances on that railway are very peculiar; they burn coal and not coke, and the Leicestershire coal which they burn, is a coal of extremely peculiar quality; a good deal of sulphur and other matter in it, in a greater proportion than in common coals; this produces a great deal of sparks, an unusual quantity; they are prevented from using a hood upon their chimney; the engines are uncovered, so that the burning coal which issues in particles from the fire is cast up the chimney with prodigious force, and scattered in all directions, almost like the bursting of a rocket, which falls on the side of the road, or the thatch, or any thing in its way, and has produced this fire; they cannot put the hood on their chimneys, because the tunnel they have to go through is so low that the chimney almost touches the roof, and they have had great trouble and uneasiness about that; and I have not found any thing has been done to remove that, except the removing combustible matter from the side of the road. From the double circumstance of the using coal and not coke, and not being able to use those proper means of precaution used elsewhere, it does not appear to me the Leicester and Swannington Railway can use them on their engines.

Did you ever hear that a field of corn was burnt on the line of the Darlington and Stockton Railway?—I think I did hear that; but there, again, I apprehend they have used the old engines unprotected; they were very rough engines, and drew nothing but coals; they do not draw passengers; they are very rough as to the construction of the locomotives.

Is it your opinion that effectual measures can be taken to prevent any danger of fire?—I have not the least doubt upon that subject at all. In the first place, with respect to the chimney, the only thing that has been done with respect to the remedy is the use of wire gauze on the top of the chimney. Your lordships will see, when they use wire gauze with the meshes so very close, nothing but the minutest dust-ashes can get through, it will be objected to that, that it will stop the draught, which is very violent in those cases; but they can increase the magnitude of it to any extent if it stops the draught in its present state; it may be made ten times as large as it is; there is no limit to the extent of it. It occurs to me, with respect to the wire gauze now actually used, to show how little possibility there is of burning matters escaping. I was making experiments on the Dublin and Kingstown Railway, and I had occasion to drive the engine with unusual speed, and therefore to get very great draught. I stood upon the tender, the carriage which accompanies the engine, and carries the water and coke; I stood upon the highest point of it, so that my head was very nearly on a level with the top of the chimney; I received in my face the ashes which escaped from the wire gauze; they were perfectly cold; there was no other inconvenience except the little bruise one's skin received.

In a case in which one of those carriages would have to go through a tunnel, would having a hood make any difference in that part of its progress?—Not with the tunnels now proposed to be constructed; that on the Leicester and Swannington Railroad was a tunnel built of the smallest possible size, barely to let the train go through, so that it passes almost like a bullet through the barrel of a gun. Now, in the present tunnels they are making them twenty-five and thirty feet high, which would be quite sufficient for any hood placed on the chimney. Then there is another point might be mentioned: it is not only that the draught from the fire escapes from the chimney, but the waste steam that comes from the engine; the moment that gets in the atmosphere, mixed with the ashes, it condenses—it is converted into water, so that the burning ashes go into the atmosphere from the chimney actually mixed with condensed steam, which, of course, must extinguish them. I am, therefore, clearly of opinion, that as to danger from the chimney it is quite out of the question, and the difficulty which has arisen in the way of fire-bars is removed; the arrangement of fire-bars used on the Manchester road has been found, as far as I am informed, very effectual, by placing them so near that the sparks are small and are immediately extinguished; but if it were considered necessary, there might be, in addition to that, a screen at each side of the fire constructed of wire gauze, which would prevent the sparks falling, except within the rails; then, if further protection is desired, a similar screen might be let down at the back of the engine, and that would actually increase the draught, for that would, as the engine passed along, catch the air, and compel it to go up the fire-bars; the only objection to that, perhaps, would be, that it would make too great a draught; this would confine the fire strictly to the road, where it would be immediately extinguished; they might even go further, and put a basket, which would carry the burning cinders in it; but it appears to me those remedies are quite superfluous; those

fire-bars would give every essential protection.

John Walker, examined.

Is a fireman on the London and Greenwich Railway. Has had his clothes burnt by sparks from the railway.

Robert Stephenson, Esq., C. E., examined.

On the first introduction of locomotive-engines on the Liverpool Railway, an extension took place in using the steam and creating an artificial blast and a very intense combustion; the blast was so much increased, it brought on us the difficulty of throwing out the hot cinders and ashes on the passengers. The inconvenience was so great that the Directors made, I believe, every species of experiment to reduce the evil, and in a degree accomplished it, not however so as to render it entirely harmless. Some accidents have recently occurred on that line; the destruction of cotton and some silk goods took place not long ago. The most effectual thing that has been done is that of covering the chimney, the orifice of the chimney, with a cap of gauze, very rough gauze. At the first introduction of that species of gauze covering the apertures were reduced gradually until they were found to reduce the draught of the engine so much as to render it almost useless; therefore, that was the point to which we could advance, and no further—the apertures in that case, however, were not sufficient to prevent the escape of the ashes in a state of incandescense, to three-eighths or half an inch in diameter. Before the gauze was applied, I have seen them fly out an inch in diameter. When the engine is pushed to the speed of thirty miles an hour, the action is so violent that the whole of the fire may be said to be in a state of equilibrium; the rushing of the air through the fire is so great, and the violence of the ignition is so intense, it is impossible, looking into the fire, to distinguish one cinder from the other, for the whole is in a state of white heat; and I have seen the cinders go from the fire, and the moment they enter the tubes of the engine, which are short, and lead them directly from the fire into the chimney, they are immediately carried up. My father, in the first instance, in his attempts to cure the evil, made the hot air to pass very near a bucket or reservoir of water at the bottom of the chimney; so that the current of air was changed in its direction, and brought very near the surface of the water; it caught all the small cinders, but not the large ones.

Charles John Blunt, Esq., C. E., examined.

I have no opinion that there is danger from the passage of locomotive-engines through such streets as will be necessarily opened on either side of a railway coming into London, or through a populous district; but should there exist that difficulty, which I do not apprehend, from the practical experience on which my arguments are founded, it may be obviated in some two or three ways. I have obviated it myself in Belgium and in France practically, and I should propose it in this country in a similar way, that is, by a shield at the back of the chimney, perhaps three times the diameter of this (*the crown of the witness's hat*). It is a shield with meshes of three-eighths of an inch, which would hold sponges, closely packed, and saturated by a small jet of water, and a little contrivance turns the action of this jet towards the shield. This, with the action of the engine, has been found to be practically efficient, not a single spark has escaped; one is now in use on an engine at work on the Antwerp line. It does not diminish the draught. It is moveable, according as the wind blows, by a mechanical contrivance. The efficacy of that depends much on the moisture in the sponge; but that can always be kept moist by a pipe communicating with the force-pump already in existence at the bottom of the locomotive-engine. It would not be found in practice an addition of 40*s.* to the cost of any engine. The shield rather inclines over the top of the chimney. Suppose my hat to be the top of the chimney, the shield is moveable, and inclines in this direction; and in the chimney also I have a little shield, against which the sparks coming are turned towards the shield; they are taken by the shield, which is a mesh-shield, as I have already explained, and stuffed with wet sponge, and which being always moist, almost in a dripping state, the sparks are put out on the instant; and I have found the velocity with which the sparks and steam from the blast-pipe leave the chimney of the engine, and next the velocity of the engine itself, essential to the perfect action of the contrivance; for when by this contrivance the engine is stationary, the sparks from the fires go up, and then I have had to put the shield over it; but then, the engine not being in action, the speed of the engine and danger from sparks is no longer a matter of question. My shield is about one-fourth or one-fifth of the diameter of the chimney. It stands parallel almost to the chimney, or is a little inclined to it; but it is immediately on the edge, the shield, and is inclined, according to circumstances. It is two feet above the mouth of the chimney. When there is occasion to alter the position of the shield, it is done by a wire; a man at the bottom can do it without going up; it would not shift with the wind; the only resistance this shield offers is the resistance to the wind, which is in a proportionate ratio

with its size; that is very inconsiderable, when you observe that the breast of the engine is so large; but I have not found it necessary to provide against sudden gusts; for the extreme velocity with which the smoke or sparks leave the chimney, as well as the velocity of the machine itself, will, without regard to whatever wind may be stirring, cause the sparks to go into the shield per force.

John Urpeth Rastrick, Esq., C.E., examined.

The principal danger to be apprehended from fire is from the coke being blown out of the top of the engine chimney, but that has been guarded against by the application of caps to it; and all the observations I have made in all the opportunities I have had, I have never seen sparks come out sufficiently large to produce fire from the top of the chimney. In fact, I have frequently rode in the Bolton waggons, which run between the Liverpool and Manchester Railway and Bolton, on the outside, and I have not otherwise been annoyed than by small particles of dust which came through the cap at the top of the chimney in one's face. Coke is a material that requires a very great degree of heat to consume it; in fact, it will not answer the purpose without a very strong blast. On board of steam-boats it would be very desirable to get quit of the smoke if possible; but sufficient draught cannot be got to produce that intensity of heat necessary for generating steam without some other means to render the blast stronger than that of a mere chimney. I have been connected with the ironworks all my lifetime; and perhaps I might call the attention of noble lords to a circumstance of one particular operation in the manufacture of iron, which is the second process; that is done by putting a certain quantity of pig iron into a furnace called a finery; then it is blown upon with a very strong blast, and coke is the material that is used. There the sparks come out at the top of the chimney to a most extraordinary extent; in the night it looks like a large firework. Now, I have always observed that these sparks, though they appear to be quite ignited when they come out in that great strength of the blast, the moment they come out they begin to die away immediately; in fact, in a great many buildings connected with ironworks, where there has been a long time of dry weather, these small particles of coke, which rise up into the atmosphere in an ignited state, fall, and fill up the spouts by the sides of the roof, and lie on the buildings till there is a shower of rain to wash it away. From that circumstance I conclude that the small particles of coke that are enabled to fly up into the air to any extent must be very soon completely cooled down, especially with locomotive engines, where a guard is put over the top of the chimney, more particularly if coke is ignited. At the time they come out they must be so remarkably small that before they have gone a few yards, they completely lose that degree of heat necessary to give them an appearance of sparks.

(To be continued.)

NOTES AND NOTICES.

Glass Cloth.—Signor Olivi, of Venice, has recently succeeded in bringing to perfection a manufacture which may prove of great value, and may be applied to many purposes of usefulness and luxury. It is the art of weaving a tissue from threads made of glass. The process of which the Signor is the inventor differs from all the attempts of the same kind which have been previously made in other countries, as it is made to take every degree of shade, from the most perfect transpareney to the deepest opaque. The thread is also rendered so perfectly flexible as to allow itself to be tied, or the tissue, when manufactured, to be folded like silk. Another great advantage attending it is, that it resists the action of fire. The specimens which have been exhibited have called forth the highest admiration, and the brilliancy of colour given to them is altogether surprising. Although the Institution of Arts at Venice has awarded medals to Signor Olivt for his invention, it is said that he does not meet with the encouragement from the Austrian Government which he expected its singularity and beauty would ensure.

Effect of a Comet's impinging on the Earth.—If a comet were to impinge on the earth, so as to destroy its centrifugal force, it would fall to sun in 64¼ days. What the earth's primitive velocity may have been it is impossible to say; therefore a comet may have given it a shock without changing the axis of rotation, but only destroying part of its tangential velocity, so as to diminish the size of the orbit, a thing by no means impossible, though highly improbable; at all events there is no proof that such has been the case.—*Mrs. Somerville.*

The Supplement to Vol. XXV., containing Title, Table of Contents, Index, and Plate of Specimens of English Medallic Engraving by Mr. Bate, was published on the 1st of December, price 6d.

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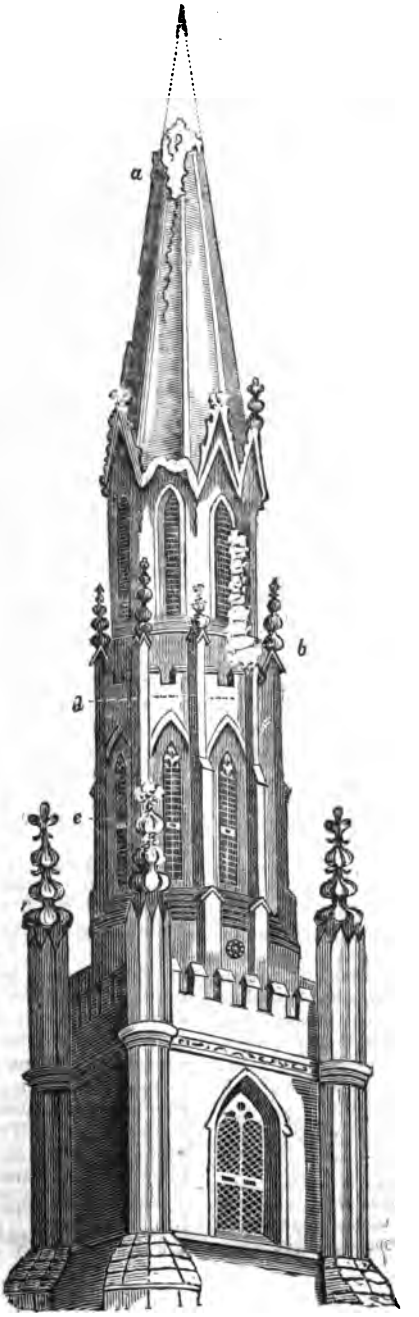
CHRIST CHURCH SPIRE, DONCASTER, AS STRUCK BY LIGHTNING, NOV. 3, 1836.



DESCRIPTION OF CHRIST CHURCH SPIRE, DONCASTER, AS STRUCK BY LIGHTNING, NOV. 3, 1836.

Sir,—In several Numbers of your valuable Magazine, I have seen communications relating to electrical phenomena, which lead me to think the following account of the destruction of the spire of Christ Church, at Doncaster, by lightning, may not be unacceptable to you; nor altogether uninteresting in a scientific point of view, as it demonstrates more fully than any accident of the kind I have ever heard of, the *efficacy* and *indispensableness* of conducting-rods.

On Thursday, Nov. 3, a thunder-storm passed over the town of Doncaster, which in its commencement was not of such an awful character as to lead to the apprehension of any serious result. After a few peals of thunder, an interval of death-like stillness occurred—when it appeared as if Nature was concentrating her powers for some mighty effort. I was standing at the time in the doorway of a building situated in a south-east direction from the church, about three-quarters of a mile distant, and was looking towards the town, when a tremendous flash of vivid white lightning, that seemed to "set all ether in a blaze," was followed, or rather accompanied, by a long, slightly zigzag streak of a dingy-reddish colour, which originated apparently in a dense black cloud at some distance north-east from the church, and took a horizontal direction until near the spire, when it gradually curved downwards, and finally struck its summit. A bright corruscation appeared for an instant on the apex of the spire; at the same time a dense cloud of smoke arose round the fabric, and I saw the displaced fragments falling to the ground. This beautiful little church was erected in 1827-8. Its site is somewhat elevated, and the height of the spire was about 150 feet. When the building was finished, a mass of glass of a somewhat conical shape was placed upon its summit, which, being a non-conductor, it was supposed might prevent accidents from lightning, to which its great height, and pointed form, obviously rendered it extremely liable.

The accompanying ink-drawing is from a beautiful oil-painting now executing by Mr. Hepworth, of this town, and is a faithful representation of the appearance of the spire on the morning succeeding the accident; the dotted lines show the original elevation.

From the present state of the spire, the following conclusions may be drawn:—The electric fluid has first struck the apex of the spire, about 12 feet of which it has shivered and thrown down; several lines of fracture appear in the remaining portion of the spire. But the main body of the fluid seems to have taken a spiral direction downwards from *a* to the lancet-window *b*, where the stone-work is dreadfully shattered. From this point it has turned again along a lead-gutter at *d*, and down a lead pipe inside one of the traceried windows below, which discharges the water between the slate composing the window; at the termination of this pipe it has again entered the stone-work between the windows *e*, (where the tower is here fractured for above a yard) until opposite the bell, where it is lost; but most probably from this point it flew to the bell, and from thence down a copper wire to the clock-work in the chamber below; of this there is one very confirmatory circumstance, viz. the beam through which the wire passes is very much rent. From the clock it has made an easy transit to the gas-pipe which conveyed gas for supplying the illuminated dials, and has followed the course of this pipe down to the earth. The plate-glass of the illuminated dials has been shivered to atoms; and a very few fragments remain in the iron frame-work, which is not at all injured. The gas-pipe along which the fluid has passed enters the clock-chamber at a circular window corresponding with the three dials, a few feet above the roof of the body of the church. A few inches below this window about eight inches of the pipe was melted, and the gas ignited; and the pipe was again melted in the interior at perhaps two yards from this—evidently proving that this was the path pursued by the electric fluid in its course downwards to the earth. It is remarkable, that while the gas-pipe, which is of copper, and about half an inch in diameter, has been melted, the copper wire connecting the bell-hammer with the clock-work, which is of the size denominated by the manufacturers No. 16, remained entire and uninjured.

This occurrence is extremely interesting, inasmuch as it proves beyond a doubt the total inefficacy of cones of glass, or

other non-conducting substances, placed on the summits of lofty buildings; and also as it demonstrates, in a most convincing manner, the importance of conducting-rods. There is no fracture any where in the walls below the pier at the side of the traceried window *e*; from this point the electric fluid has found a series of conducting bodies capable of carrying it off, and to this the preservation of the lower part of the structure is most probably owing.

I am, Sir, yours, &c.

I. R. H.

HOUSE-BURNING SYSTEM.

Sir,—Will Mr. Baddeley, who may truly be termed the "Amateur Fireman," tell me—

1st. Whether a more effective instrument than the fire-engine now in use is desired by the Fire-Insurance Companies? If not, as the lawyers have it, why not?

2d. Why Mr. Braithwaite's steam fire-engine (which all admit to be an effective instrument) has not been adopted?

3d. Whether a return could be had of the number of fires for a given time (twelve months) distinguishing between insured and uninsured; stating, also, whether the fires began in the one class of property or the other; and what the relative loss of property in each case, compared to the other, is?

I bethink me a negative will be the answer to my first—fear of "Othello's occupation being gone," to my second—and an exposure that would lead to public reprobation, to my third query. Mr. Baddeley is an extremely intelligent man, and clever writer; let him show himself honest and fearless also, by "nothing extenuating" in his reply, for he appears to know more of this matter than we of the commonalty do.

Your obedient servant,

FIRE-FURY.

STRICTURES ON THE ELECTRICIANS.

Sir,—I trouble you with some observations on electricity, and also on a species of mania which has of late years possessed the greater number of the students in the science; and in particular branches of it, so bewildered their understandings, that they seem to have quite forgotten the advice of their great guides, Bacon and Newton, by following which so many great discoveries in this science have been made.

I suppose it is the greatness of these discoveries, added to the love of novelty, that has produced this unfortunate aberration of intellect, which I beg leave to name *electrophobia*. Its baneful effects have chiefly appeared in an almost total abandonment of the inquiry into the fundamental principles of this noblest of physical sciences, which it so much concerns the astronomer, the chemist, the geologist, and so many *ers* and *ists* besides, to be well instructed in; and without a more searching inquiry into which, I am inclined to think the subdivisions of the science, magnetism, galvanism, &c., will, in some of their more abstruse principles, remain long in their present obscurity.

Franklin framed a beautiful theory, considering the infancy of the science in his time; and in his principles (and assumptions, too) the English philosophers, who at first neglected him, have become quite fast set—so much so, that ever since they have scarcely dared to question them.

Though neither he nor they could untie the knot of negative recession, which he assumed to be repulsion, yet, with a truly Roman, undoubting, steadfastness they seem resolved, at all hazards, to persevere in that assumption. Witness, amongst other instances, Dr. Ritchie's and Professor Stevelly's observations in answer to Professor Hare, at Bristol last August.*

Mr. Du Fay (according to the French philosophers), Mr Eeles (according to the Irish), and Mr. Symmer (according to the English)—forgetting the simplicity of nature and Newton's consequent rule, not to admit more causes than a necessary to explain natural phenomena—created another electric fluid to untie the Gordian knot of negative recession, as Franklin had before created a new power.

I am compelled to believe, as far as

* I should feel extremely obliged to any one who would refer me to any account of the experiments then mentioned by Dr. Ritchie, where the gold-leaf electroscope diverged in vacuo. The Doctor's assertion seems directly in the teeth of similar experiments by Sir Humphrey Davy with the cork-ball electroscope, and which I met with somewhere in the *Philosophical Transactions*. In these on the gradual abstraction of air the electrified balls gradually diverged, and the converse on its gradual re-admission.

my present information of facts goes, that there is no such thing as repulsion in nature. Attraction alone (pursuing Newton's rule) seems to me sufficient to explain every thing that it concerns in electricity, or other sciences, far more reasonably than with the assistance of that hypothetical and unsocial force repulsion. I formed this opinion three or four years ago, as soon as I had acquired any thing like a comprehensive view of the subject; and I was still more confirmed in it by the fact of two friends, to whom I named it, having also come to the same conclusion.

Pursuing the consideration of the subject, additional arguments suggested themselves till I acquired a belief in homogeneous attraction of electricity also.

Magnetism and electro-magnetism furnish the greatest obstacle to the rejection of repulsion altogether; but let us go back from those more complicated subsciences in which the discovery of Oersted, and others, has given our philosophers the above-mentioned *phobia*, and inquire whether we are right in sustaining Franklin's assumptions from the fewer facts then known, as well as his incontestible principles, if any such there be. Let us go back, I say, to the foundation of the science, to machine electricity, when our first inquiry will be whether electricity be in reality matter and a fluid. It is still much questioned, but I could perhaps demonstrate it from past experiments of others (which have not been closely enough examined), without resorting to nearly 200 experiments I have noted down for trial on the particular point, and one or two of which I have made.

Under this first head, as necessarily connected with the experiments I shall propose to prove it, I intend to introduce some new considerations on the best mode of forming conductors, so as to produce the maximum effects depending on the tranference of electricity.

Under the same head, also, will perhaps not inappropriately come the consideration of a method of measuring the velocity* of electricity, which, I do not doubt, may be ascertained as accurately as the motion of any other fluid, as I think I perceive sources of fallacy in the principal attempts already made. At the same time will be considered a method of ascertaining the time taken by the fluid in passing a particular point in the circuit.

These latter topics will naturally lead to observations on the experiments of Dr. Watson and the Royal Society, tending to show a fallacy in their assumption, of the electricity in those experiments being in motion in a complete circuit from the inside to the outside of the phial, and to the suggestion of some experiments that must, I conceive, settle the question.

If electricity prove to be fluid matter,† the next thing will be to show it has an attraction for other bodies, a thing I suppose not doubted by any one who thinks it is material. After which, I think it will not be inappropriate to discuss a question that I have never seen glanced at even by those who deny repulsion. Has electricity homogeneous attraction? I think it has—I feel scarcely a shade of doubt of it. I think it might be satisfactorily established from recorded experiments, independently of 30 or 40 experiments that I have noted for trial on the point, and which I fancy must settle the question *pro* or *con*. If settled *pro*, away goes all the old rubbish about electrical repulsion; unless, indeed, its supporters will say that the particles of electricity have the paradoxical property of both attracting and repelling each other. As well might they say the parts of a sponge repel each other when they make way for the water their attraction forcibly brings into its pores.

If the experiments on homogeneous attraction of electricity should prove its non-existence, the question of repulsion still remains open, and I have numerous experiments noted for trial to negative

* Since I first wrote the text, I have found in a little annual lent to me (called *The Arcana of Science and Art*), a short account of Professor Wheatstone's method by means of a revolving mirror. My method is intended to register the velocity, and the time also occupied in passing a particular point.

† I have long thought it might be the undulations of this fluid, extending to the sun and pervading all things on earth, that caused light; but have little considered it. At present nothing has occurred to me that militates against that supposition. I have been the last few months doing what I have contemplated a year or two past, constructing a balloon to carry up a cord with brass thread in it, to ascertain the relative quantities and intensities of electricity at different heights; but this plan I have not yet had time to complete. If electricity do extend and increase in intensity to the greatest attainable height, why may it not extend to the sun?

that also, as well as arguments from past experiments, some of which have most strangely been considered as proofs of repulsion. By the way, let the repulsionist answer this question—Why is it that electrified pith-balls will lie sociably enough together at the bottom of an electrified cup or a jar insulated, while attempted to be charged by the outside coating, and not fly up and hang suspended in air at a respectful distance from each other in the manner it is supposed the atoms of gases do? I have a great horror of this savage doctrine of repulsion. Let us once get rid of it, and establish homogeneous attraction in its place, and I fancy the science of electricity in all its branches will be found to have been freed from an incubus that has very much retarded the progress of discovery, great and wonderful and beautiful as that progress has been notwithstanding.

The beautiful simplicity of nature is assented to by every tongue. Let every head assent to it likewise, and, taking Newton's advice, determine to reject every cause that can be dispensed with in explaining and experimenting upon natural phenomena.

When homogeneous attraction is established, perhaps some thoughts on the causes of conduction and non-conduction, as depending upon it, may be admissible. I suppose no one pretends now that the recession of water from greasy surfaces, and of mercury from iron ones, are instances of repulsion; but that every one acknowledges such recession, is caused by the homogeneous attraction of those fluids being greater than their attraction for those surfaces. When homogeneous attraction is admitted in electricity, I trust it will not be deemed too great an assumption to consider the superiority of that power to the power of affinity as the cause of non-conduction.

These three qualities—materiality, attraction of affinity, and homogeneous attraction, being once established as belonging to electricity, perhaps the film will at once drop from the eyes of our philosophers, and enable them to see with a glance into many things now quite inexplicable. Perchance they may even be induced to talk of latent and free (I do not mean active) electricity, and of specific effects arising from the peculiar motions of each.

In all the instances I have met with of the denial of repulsion, that denial appears to have been treated either as presumptuous or ridiculous, and perhaps the first proposition of the bolder assumption (I will not at present claim a higher title for it,) of homogeneous attraction in electricity will meet with a still less ceremonious treatment; but I can afford to wait for its admission, and, as far as my own selfish feelings are concerned, should have no objection to find it denied till I have leisure and the pecuniary means (alas, at present, a very distant prospect,) to attempt the establishment of it by experiments of my own making. However, I am anxious not to lose any credit that might accrue from the first promulgation of this doctrine, and shall be obliged by your insertion of this letter, as well as two or three others that I am desirous of publishing on the points before-mentioned.

CORPUSCULUM.*

Leamington, Nov. 29, 1836.

EXTRACTS FROM EVIDENCE GIVEN BEFORE COMMITTEE OF THE LORDS APPOINTED TO INQUIRE WHETHER ANY DANGER BY FIRE IS LIKELY TO ARISE FROM LOCOMOTIVE-ENGINES BEING USED ON RAILROADS PASSING THROUGH NARROW STREETS.

(Continued from page 176.)

George Stephenson, Esq., C.E., examined.

The first scheme to prevent danger from sparks from the engines on the Liverpool and Manchester Railway, was to put the wire under the chimney immediately above the tubes that come from the fire. It certainly lessened the number of the sparks; but that part of the wire soon got choked up, and the engine could not go on. Then we tried it at the top; there it was something like this, but not so close. They could not get power enough with even that; it varied as the apertures of various sizes, till we were obliged to enlarge them. They were tried down to one-eighth of an inch; I think it was about that, but it was a wove wire; it was a number of concentrated rings. There is another scheme which I tried, of putting a large umbrella without any wire so far above the chimney, that all the sparks thrown out must

* We shall be happy to receive the future lucubrations of our correspondent. The address inquired for by him is, "Conduit-street, Regent-street."

be thrown back again by the umbrella; but even that retarded the engine so much that I was obliged to give it up. It stood a foot above the chimney, then it came down the sides. The wind blowing will not measure with the carriage; it goes so much faster than that. A sloping inside shield at the lower part of the chimney, and again a sloping shield put at the top of the chimney, the second partly to cover the aperture left for the first, was tried on the Liverpool at my suggestion. My opinion is, it will not prevent the sparks coming, for if there is an outlet for the steam there is an outlet for the sparks. It is not confined to apertures; there it has a larger opening; the sparks will follow the current. I had a number of shields put down like a Venetian blind in rows, or like a Venetian blind hanging down like the shield spoken of; eight or nine of them I added at the bottom, and though there was plenty of space beside the shield, yet it retarded the power of the engine so much as to cause us to take it off.

J. Walker, Esq., C.E., examined.

As regards the importance of guarding against fire, I would beg to state that I have had a good deal to do with the subject of water-works for towns, particularly the very large water-works that were projected for the supply of the greater part of London. The prevention of fire was one of the articles that the parties held out in their prospectus as one of the inducements to subscribers and to the public to come forward to encourage these water-works, and of all other parties I expected that the fire-offices would be the more ready to attend to it; however, after giving the thing a good deal of consideration, and going to one or two of the offices, I was surprised to find the great indifference they had towards it, and I inquired how it was, and I remember one of the officers told me the truth was that they gave themselves little concern about, because it did not injure them; I said, "How does it not injure you, have not you to pay the losses?" His reply was, that if they had not fires occasionally they would have no insurances.

Hardman Earle, Esq., Managing Director of the Liverpool and Manchester Railroad, examined.

The first accident we had, I think, was occasioned by a single waggon of merchandise catching fire, and being communicated to the next it was entirely consumed, and the waggons also. We have, I should state, frequently on the sides of the road set on fire the long grass in summer-time; and the furze-bushes have also been set on fire; and our attention has been consequently called to it, and we have devised several means to obviate it. Your lordships are aware that a sudden blast up the chimney carries the coke along with it; the vacuum in the chimney formed by the steam being discharged into it causes the air to rush through the fire-place, carrying up with it out of the top of the chimney small particles of coke; we were under the impression that the accident arose from that cause, but we have since discovered that that was not the case; we put on the chimney-top what we called a bonnet made of wire with small meshes, which prevented any large embers escaping up the chimney, but we still found we were liable to accidents; we then discovered that it was the coke dropping through the bars, and falling upon the wheel going with great velocity was thrown a considerable distance. In all the accidents we have had on the road we found that it was those waggons in the train, two or three removed from the engine, which took fire, and therefore it could not arise from any thing that was cast out of the chimney, because those particles describe a very large arch and come down farther behind the train; and this led us to put what we call ash-boxes beneath the fire-place. Still we found when those got full, the cinders, by the shaking of the road, dropped out, and we were still liable to meet with accidents, and we now therefore have them inclosed back and front. There certainly has been since a difference in some measure in the draught through the fire-place of the engine, but not such as to impair its efficiency, and we have had no accident since that was done. The waggons consumed at the first accident contained cotton wool; there were about 200*l.* or 300*l.* worth destroyed; and at the last accident 3000*l.* worth of merchandise, it being unfortunately silk goods. We paid for the damage, but I believe it was rather a doubtful point whether we were really obliged to pay, the goods being silk, and not specially mentioned as silk goods; but we did pay; we thought it our interest to pay, and we thought it right besides; it being a contingency which the parties did not and could not expect. There have been minor accidents, such as females having their shawls burnt, small holes in them, and men in the second-class trains, which are open, having some holes burnt in their coats; but since we have had the engines fitted up with those bonnets and ash-boxes we have not had any serious accidents, and do not expect we shall. But I should state there are other engines on the road besides these belonging to the Company; there are engines belonging to the Bolton Company and to colliers on the line; and the latter are not quite so particular, as the article they carry is not of that combustible nature as to be

likely to be set fire to by sparks. It is an order that they should be done, and they profess to be in the course of doing it; but they are not quite so quick in their movements as perhaps they ought to be, and from that cause we may have lately had a little dry grass burnt on the road-side, which any person passing along the road may have seen evidence of.

Would you, as an individual member of a railroad company, prefer being compelled by legislative enactments to use particular precautions, or would you prefer being made liable to any damage which might be proved to have occurred by the locomotive-engines to the property of individuals through whose land the railroad passes?—I should rather, certainly, have the legislative enactment, if that prescribed the sort of security that the Legislature would deem sufficient, because it would be the duty of the railway to adopt it; but that security must not be incompatible with performance of the engine. You might close every thing up so completely that no fire could come through, but the draught would be so impeded that you could not make steam.

If there were legislative enactments respecting the use of caps, or a tray under the fire, would it not be easy to evade those regulations or to neglect the precautions?—It certainly would be, just as it would be easy for a hackney coachman not to have his plate on the door, but he would be subject, I conceive, to a fine if it was omitted.

Do you not believe the most certain way to secure the public against danger would be to subject the proprietors of railways to the liability alluded to?—I think it would be an immense liability; you might ruin a whole concern.

Do you not believe that if the law were to cast that liability upon the proprietors, that they would consult scientific men who would discover precautions that would make that liability in truth one of very little extent?—I think it might involve such very important consequences, that it would really be a serious objection to having any thing to do with property in railways.

You have stated that you believe there is but little danger to be apprehended from fire?—But that is a different thing from fixing the liability on the Railway Company by law. It is possible that such a thing might happen, and the public are not so well aware as I am of these things, because I see them every day. Many people have a great dread of a railway who never saw one, but I have not that dread who have it before my eyes every day.

But in case of accident, do you not think that it is but fair that the company who are most likely to profit by the railway, are those persons who ought to pay for the damage which may have occurred from the use of the locomotive-engines?—I am not sure that I do. A person may carry on a very beneficial manufactory to himself which is more liable to ignition than another, and yet it would be very hard to make him pay because he happens to set all his neighbours houses on fire.

Would it not be still harder on the neighbour to have his house burnt down?—It is a contingency that the neighbourhood expects, and being in a dangerous neighbourhood he insures his property accordingly.

But then he must pay a greater premium in consequence?—So he may.

Is it not very hard and unjust to force a man to sell a portion of his land and then to burn the crops which he retains?—If he can prove they burnt his crops it would be.

With the improvements that may be made in the progress of invention in locomotive-engines, is it not more than probable that they may be made so perfect that no accidents can arise; do you not think it a just principle that if you, for instance, had your house burnt down by one of the engines, the company who employ the engines should pay for the damage done?—These are opinions which I hardly expected to be asked, and they involve questions of law and equity which I perhaps am not equal to answer on the moment; they require a good deal of consideration.

You have stated that you do not apprehend any danger?—I am not very sanguine about very great improvements being made in these engines; we have now been at work many years, and there has been no improvement in the principle, though there have been improvements in the details. The engines are more durable, but there has been no improvement in the principle as yet; and I think that with these precautions the chance of accident is very remote. At the same time that is a very different thing to fixing the liability on the Railway Company by law.

If there is no danger according to your statement, or the danger is very remote, the liability cannot be much?—I do not know that it is much.

Then, why should you feel so great a repugnancy to the liability being thrown on the Railway Company?—Nobody likes to have more liability fixed on them than it is necessary to bear; and therefore it is but reasonable to object to it.

Do you not believe that practically it would be found if the railroad proprietors were subject to responsibility for any damage done by fire arising from the locomotive-engines, that they would exert themselves in such a manner as to provide precautions

against danger, and that in point of fact they would be subject to very little loss in consequence of damage that might arise?—That would be the strongest inducement they could possibly have to take every pains in their power.

As a practical man, do you not expect in progress of time the calls made upon them for damages will be so small that they would have no apprehension at all?—I think the chance would be very much reduced of fire; but if you make a public company of this kind liable, it might give rise, I apprehend, to very great frauds.

In speaking of the liability to which the proprietors ought to be subject, I am supposing it to be clearly made out that the accident from fire did arise from the locomotive-engine?—But it is not always very easy to prove it. With all these precautions the thing may happen, and you lay it on an engine; it might have happened from a man smoking a pipe or a cigar on the train.

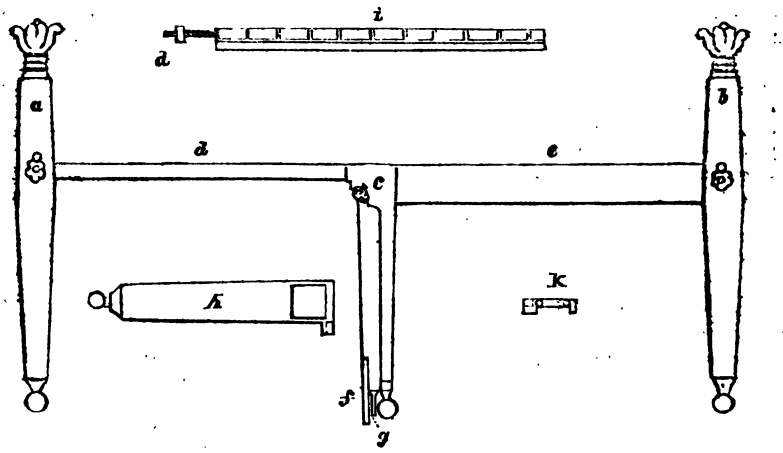
But is it not the duty of the proprietors and of their servants to take care that no danger of that kind shall arise?—Yes, it is; to do their best.

What is the amount of damage you have paid, since the Liverpool and Manchester Railway has been opened, from fire?—I should think about 4000*l.*, of which 3000*l.* was on one occasion. We cover up all the merchandise with oil cloth.

You consider side walls are most essential precautions?—Yes, I think so, in case of accidents. All the new railways that are making now have mounds along the embankments which answer the double purpose of preventing the engines in case of their going off the rails from going down the embankment, and the cinders from setting fire, though they were not intended for the latter purpose.

Do you, as a gentleman of considerable experience employed in the direction of the greatest railway in the country, think there is no danger from the locomotive-engines used at present, due precaution being taken; is that your distinct opinion?—That is my distinct opinion, due precaution being taken and persevered in.

IMPROVED SLIDING-UP BEDSTEAD.



Sir,—I have often thought some other means of diminishing the size of a bedstead when not in use than that of folding up would answer, and have been much surprised that no improvement has ever been suggested in this respect, particularly as there is not a little danger attendant on their being folded up, and when up, of their falling, from the pressure of the bed and bed-clothes within, or the slightest pull from without. As females too, generally, have this domestic operation to perform, it becomes an object of humanity to change the common form for some one more safe, yet equally convenient.

I have endeavoured to supply this desideratum, in a way which it appears to

me would be not only equally cheap, but calculated to improve the appearance of the bedstead.

Description.

a, the head-post; *b*, the foot ditto; *c*, an iron leg, firmly attached to an iron bar *d*, for the purpose of holding the laths of the bedstead, under which is a groove to allow the half of the side *e* to pass along it; and thus by turning the piece of iron *f* horizontally, the leg will fall on the castor *g*, and the side *e* will then slide freely along till the post *b* is up to the leg *c*, making the bedstead half its common size. *h*, side view of leg *c*, showing the hole through which the side *e* passes. *i*, inner view of iron bar, showing the recesses to hold the laths. *j*, end view of same, with two screws passing through head-post, and secured by nuts. *k*, end of the bar, showing the groove in which the side *e* slides. The top may be made to contract by a weight attached to a cord running on a pulley behind the head-post, or a rail made fast to the head-post, and the lower one run on it by a wheel in a groove.

The lower end of the bedstead is always one inch lower than the upper.

I am, Sir, yours, &c.

T. R. CROFT.

CALCULATION OF THE DISTANCE TRAVELLED BY MR. GREEN'S BALLOON ON ITS LATE CONTINENTAL VOYAGE.

Sir,—I am much obliged to Kinclaven for pointing out the error I fell into in my application of Leadbetter's solution for finding the year when our present north pole star will be south of the zenith of London. I am now perfectly satisfied; and fully agree with Kinclaven, that there can be no change in the latitudes of places so long as our earth continues to revolve upon the same axis. I here beg leave to state, that I had no intention of becoming an advocate for Mr. Mackintosh's electrical theory of the universe. I am fully aware that the greatest part of it is founded upon a bed of sand.

I observe that your correspondent, Mr. Richard Evans, or rather his friend, the Actuary of the Savings' Bank of Swansea, in No. 695, has given a calculation of the distance Mr. Green's great balloon travelled in its late Continental trip; his *method of solution is perfectly false*. He makes the distance between Vauxhall Gardens and the town of Nassau to be 482·86 geographical miles, which would be 559·13 English miles; whereas the distance in English miles (allowing the latitudes and longitudes to be as stated by Mr. Evans) will only be 359 miles. The true solution by spherics will be as follows:—

Solution.

Assume $90 - 50^\circ\ 16' = 39^\circ\ 44' = a$
$90 - 51\ 31 = 38\ 29 = b$
$7^\circ\ 57' = C.$

Then we have two sides of a spherical triangle and the included angle given to find the third side, which will be the distance required.

$a = 39^\circ\ 44'$ log. sin.	9·805647
$b = 38\ 29$ log. sin.	9·793991
$C = 7\ 57$ log. ver. sin.	7·982762
	27·582400
$a - b = 1\ 15$ log. ver. sin.	6·376527
2 log. tan. ϕ	21·205873
log. tan. ϕ	10·602936
$\therefore \phi = 75^\circ\ 59'\ 27''$.	
2 log. secant ϕ	21·232092
$a - b$ log. ver. sin.	6·376527
	27·608619

10 + log. 2 . . . . . 10·000000

2 log. sin. $\frac{C}{2}$ . . . . . 17·307589

$\therefore$ log. sin. $\frac{C}{2}$ . . . . . 9·653794

hence $\frac{C}{2} = 2^{\circ}\ 34'\ 96'' \therefore C = 5^{\circ}\ 9'\ 92'' = 309·92$ geographical miles,

and $\frac{309·92 \times 69\frac{1}{2}}{60} = 359$ English miles.

Had the question been solved upon the principles of Mercator's projection, the distance would have been the same as above.

But it was stated that the balloon descended near the town of Weilburgh, which is 23 miles north-east of Nassau, in latitude 50° 18′ N., longitude 8° 26′ E.; also, the true latitude of Vauxhall Gardens is 51° 30′ 15″ N., long. 0° 8′ 30″ W. In this case the distance will be somewhat more.

Solution on Mercator's Principles.

Lat. Vauxhall	51° 30′ 15″ N.	(Mercator's principles)	3617·1	long. 0° 8′ 30″ W.
— Weilburgh	50 18 0 N.	— —	3502·6	long. 8 26 0 E.
	1 12·25		114·5	8 34 30
	60			60
Diff. lat.	72·25		Diff. long.	514·5

Mer. diff. lat. 114·5 log. . . . . 2·058805
Diff. long. 514·5 log. + 10 . . . . . 12·711385

Tan. 77° 27′ 13″ Log. 10·652580

Log. secant 77° 27′ 13 − 10 : . . . . . 0·668080
Diff. lat. 72·25 . . . . . 1·853838

Geographical miles 332·6 Log. 2·521918

Hence $\frac{332·6 \times 69\frac{1}{2}}{60} = 385\frac{1}{4}$ English miles.

And allowing for a little traversing in the air, the whole length of the trip could not have been much under 400 miles.

Trusting, Mr. Editor, the above will be some atonement for my former mistake,

I am, Mr. Editor, your humble servant,

O. N.

Dec. 3, 1836.

MANIFOLD WRITERS.

Sir,—At p. 112 of vol. xxvi. you ask me to send you a description of my machine for taking several copies off a letter with expedition and secrecy. That is a thing I will most willingly do, so far as I can, without the risk of injuring my own interest; more than that, I imagine you do not at present expect.

The machine, with its appurtenances, forms an elegant though small piece of furniture to stand on a library table. Any number of copies can be taken at about the rate of sixty or seventy in an hour, and the machine becomes ready for taking copies in five minutes after the letter is finished; and to finish which,

takes only the usual time for writing a letter.

Any gentleman or lady may take copies with ease, as the method requires no more attention than common writing, and is done without soiling the dress or the hands. This way of multiplying copies does not, like lithography, require dabbling in water, nor is it attended with such delay, dirt, and disappointment, as usually attend lithography.

At some future time I will send you all the particulars and a drawing of the machine.

I am, Sir, yours, &c.

F. P.

Hereford, Dec. 5, 1835.

REMARKS ON THE REPORT OF THE COMMITTEE ON ARTS AND MANUFACTURES.

Sir,—One of the most striking features of the recent Report of the House of Commons' Committee on the Arts in connexion with Manufacture (reprinted in No. 693 of the *Mechanics' Magazine*), is undoubtedly its decided hostility to every thing English, — not even excepting English grammar. At the very outset the Committee are anxious to state the inference they say they are "*obliged* to draw from the testimony they have received; that, from the very highest branches of poetical design down to the lowest connexion between design and manufactures, the arts have received little encouragement in this country;" and the chief objects of all the rest of the rambling disjointed mass which they style their "Report," seems to be the maintenance of this position, especially by throwing discredit on our native artists and artisans, to the glorification of their Continental brethren. By saying that the arts have received "little encouragement" in this country, the Committee evidently mean to insinuate that they have made little progress; and in order to bear themselves out in this view of the case, which they profess to have arrived at "with regret," while they evidently gloat on it with delight, they (inadvertently, no doubt,) omit all mention of various facts detailed by some of the witnesses examined, which tend to prove the existence of the very reverse of that state of things, which caused them so much sorrow.

For instance, while the Committee state that "it has too frequently, if not uniformly, occurred, that the witnesses have felt themselves compelled to draw a comparison more favourable, in the matter of design, to our foreign rivals, and especially to the French, than could have been desired," they cannot find room for even the slightest notice of the fact spoken to by one of the witnesses, that many of the most favourite *French* patterns are in reality executed in England; or of the other pointed fact deposed to by another (previously brought forward by a correspondent of the *Mechanics' Magazine*), that the most highly-prized *French* china of the tasteful author of "Anastasius,"—the very specimens adduced by him in proof of the superiority of Gallic design—were in good truth executed at Worcester by an English artist! It is the same to the end of the chapter; the Committee seem to have lost their memory entirely as to any fact creditable to the talents of their countrymen. In the course of the evidence many other circumstances of a similar complexion are alluded to, which in the aggregate would go far towards invalidating the sweeping conclusion the Committee so readily arrived at; but it would be in vain to look for them in the impartial pages of the Report.

In one important branch of the arts—engraving—however, English superiority is so manifest, that even this anti-national Committee are reluctantly compelled to devote a paragraph to the confession that "British engraving has attained a high degree of excellence." But this little tribute of justice is paid most characteristically. How may it be supposed the Committee discovered the fact? They surely could not trust the evidence of native barbarians, or of their own eyes! Certainly not;—but "*foreigners* send pupils hither for education, and the works of British engravers are admired *on the Continent!*" This helpless dependence on foreign judgment is indeed ridiculously apparent in every line of the Report. The Committee recommend particularly the purchase of paintings of the Raphael era for the national collection. Why? Because "they have been sought for as the basis of the new National Gallery *at Berlin.*" Portraits are to be excluded from the exhibitions of the Royal Academy, and for what reason?—Because

"the remarks of *foreign* critics have frequently been elicited by their unusual predominance:" (*British* critics, it is left to be inferred, are in raptures at the arrangement, or rather, what they think about it, is deemed unworthy of notice). And, stranger than all, although "the exclusion of engravers from the highest rank in the academy" seems to have had no effect in preventing them from taking their station in the "highest rank" of European art, we are called upon to change our system in that respect—not on the ground that it would lead to their further improvement, but for these very valid reasons—that the exclusion in question has "often called forth the animadversions of *foreign* artists"—that, in the *French* academy engravers are admitted into the highest class of members—and that it is the same "in *Milan*, *Venice*, *Florence*, and in *Rome!*"

What would the Committee have said had the case been the other way—had the exclusive system been that adopted by these foreign academies, and had *their* engravers been the first of their day? Of course they would not have hesitated to insist on our immediate falling in with the foreign academic plan, as the obvious means of cultivating excellence in this branch of art. It is easy to imagine the flourish they would have introduced about the barbarism of conferring the same degree of distinction on the cultivator of "high art" and his mere copyist, and how blandly they would have referred to the different style of managing these matters *on the Continent!* As it is, although "the boot is on the other leg," we are still to go to "foreigners" for instruction: they enjoy the royal privilege—"*foreigners* can do no wrong."

The state of this art of engraving is altogether a sad stumbling-block: if it be true that the arts have "received but little *encouragement* in this country," it is equally true that in this great branch they have made an amazing progress *without it*; so great, indeed, that it becomes a question whether the other branches of art, to which some degree of "encouragement" is extended, would not get on all the better without any. Not that even they are in *quite* so miserable a state as the Committee would wish us to infer from their Jeremiads over the national taste. In Germany, at this moment (and surely the authority of the *Germans* will have great weight), they are publishing annuals not only with English engravings, but with English engravings from English drawings! Strange state of things, indeed, when the "classic country of the arts", (as Bavaria is styled by the Committee, on the strength of the King's having condescended to patronise them for some dozen years or so,) can receive inspiration from such a Bœotia as England. This instance, even, is not so striking as another. After the "regret" of the Committee at the wretched state of the arts "down to the lowest connexion between design and manufacture" in this country, and after their raptures at the universal diffusion of art in France, *in consequence of its cheapness*, it could hardly be expected that they should promulgate the very pointed fact that France is indebted to "this country" for the *very cheapest* and most extended means of diffusing "art" among its population. They do *not* promulgate it; but they might have done, for, had they before been ignorant of so notorious a matter, the evidence of Mr. Cowper must have made known to them that the stereotype plates of the *Penny Magazine*, manufactured by the ignorant English mechanic, from blocks cut by the unencouraged English engraver, after the designs of the uncultivated English artist, are regularly exported to Paris for republication there in the *Magasin Pittoresque*, and other spreaders of "cheap art." Nay, more they might have discovered, had their inquiries been directed that way, that one reason of Mr. Knight's being able thus to supply "art" to the very artistical French at a cheaper rate than they could manufacture it themselves, is the unparalleled extent to which the original impressions are previously sold among our own countrymen![*]

In this case, again, it is easy to conceive how learnedly the Committee would have descanted had the importation been from France to England; how clearly they would have shown how the universal diffusion of a taste for the arts *on the Continent* combines with the su-

[*] It may not be out of place to mention another illustration of the remarkable fact noticed in the text, that stereotype casts of the plates of the *Mechanics' Magazine*, supplied from the *Mechanics' Magazine* Office, form the principal graphic embellishments of more than one Continental contemporary.—ED. M. M.

periority of the *French* taste in design, and the attention paid *in France* to the connexion between art and manufacture, to enable our neighbours to enlighten, in some degree, our deplorable darkness! But how do they account for the existing anomalous state of things—anomalous according to their view of the matter? Simply by omitting all mention of the fact. They just cursorily observe, that "the *Penny and Saturday Magazines*, the *Magasin Pittoresque*, the *Magasin Universel*, and other cheap works issued in *France and Germany*" (thus depriving poor England of all share in the credit), are "mainly indebted for their success to the printing-machine" (without a word as to the *engraving* exportation system), and then pass on to renewed admiration of the splendid publications of Professor Beuth, of Berlin. Of course, often as the excellencies of the illustrations to that gentleman's "Vorbilder für Fabrikanten und Handwerker" are dwelt upon, it is never even incidentally observed that he was obliged to send to England to find engravers competent to the execution of his finest plates.

It would take up a whole Number of the *Mechanics' Magazine* to expose a tithe of the fallacies and inconsistencies of the Report in detail; but it may perhaps be worth while to notice one of the most prominent of its *beauties*. Among these its style is conspicuous; we are told of "the era of the *Renaissance*" instead of the *Revival* of art; are informed that the Royal Academicians claim the exclusive privilege of "*consorting*" with the patrons of art at their annual dinners; are assured that, at the exhibition at Somerset House, "portraits often *inconsistently obtrude themselves* before historical compositions;" and warned against the "prevailing fashion *for* what is called Elizabethan architecture; a style which, whatever may be the occasional excellencies of its execution, is undoubtedly of *spurious origin!*" (This is horrible!) It is in the bathos, however, that the Report particularly shines; the excellence of the following passage in that particular must be too obvious to need a word of comment:—"Few circumstances can more fully exhibit the hitherto exclusive nature of our institutions, than the fact that we have only just began to form a National Gallery. *The new building, now nearly completed, has been thrown back to open the façade of St. Martin's to Pall Mall—an alteration in his original design which the architect much deplores.*" The old stave—

> "And thou, Dalhousie, thou great God of War!
> Lieutenant-Colonel to the Earl of Mar,"

was nothing compared to this. The easy transition from a general view of the scope and tendency of our institutions, to a particular view of the scope and tendency of the removal of Mr. Wilkins's building a few feet further back, is inimitable.

Upon a careful perusal of the Report, too, it must be confessed that much may be said in defence of the Committee's omissions. It is no wonder they could not find a corner in which to notice any of the facts creditable to English art which came under their cognisance, when they were anxious to communicate, with all due seriousness, the important discovery—most important, indeed, when it is considered that their principal object was "to inquire into the best means of extending a knowledge of the principles of design among the people"—that "the great picture of Sebastian del Piombo has been *exposed to hazard from the incursions of insects!!!*" When they had to find room for such a fact as this, it is not surprising that they could not spare any for less pressing purposes. The interests of the British mechanic may surely be let to "go hang" when a single picture of the "national collection" is in danger!

For the present, at least, I take my leave of the Committee, apologising for the rambling nature of these few hasty remarks, which may well be laid to the door of the truly rambling document they take for their text,

And I remain, Sir,

Yours respectfully,

H.

London, Dec. 7, 1836.

PROBABLE CONSEQUENCES OF AERIAL NAVIGATION.

(From *Blackwood's Magazine* for November.)

Who shall say that the same air which carries a raven, a lumbering bird, or an eagle as heavy as a lamb, and sometimes both lamb and eagle, may not yet be able to carry machinery enough to move a balloon "according to the way it should go?" Green's balloon now carries up the cognoscenti of Lambeth Marsh by the dozen, at so much a head, takes them down to Essex (there being, of course, some understanding on the subject with the innkeepers and county gentlemen), suspends them in ecstacy over the river, gives them the pleasing variety of a flight with a fair wind for the Chops of the Channel, then turns coolly round, and drops them in a field at Chelmsford or Canterbury, just in time for tea at the principal inn, and a triumphal entry into Vauxhall exactly at supper.

If this balloon is powerful enough to carry twenty people, which is said, we shall probably soon see some little steam apparatus superseding the crowd, and a steersman and a *stoker* urging their swift and solitary way with the mail-bags from Dover to Dalmatia, while a branch-balloon carries the news of the world from Calais to Constantinople, Caffraria, Coromandel, Cochin China, and with a slight bend to the south, to California and home. This would be a glorious sweep. But what would become of the wisdom of the world below? What would be the consternation of all the little German highnesses on finding that all their little precautions against the *entrée* of books, papers, and politicians, were set at nought by a new steam-coach, travelling five miles above their heads, and sending down trunks and travellers every five minutes per parachute? What would become of the thousands of meagre clerks who sit shivering all day in their little dingy offices, living on the fees which they can extort in the shape of passports? A flying castle in the clouds would extinguish them and their captious trade together, sweep over boundaries and ramparts at the rate of forty miles an hour, and require nothing but a basket and a rope to hoist the victim of the Alien-office beyond the reach of all the gens-d'armes of the Continent.

Yet is this all to be a dream? Are the powers of this great machine to be wasted for ever on a holiday show? On dropping Dukes of Brunswick out and taking Cockneys in? On gathering guineas into the pocket of the future Mr. Grahams, and putting their future wives wide and wild between the sky and the earth? Are we never to have the power of traversing the deserts of the south, the forests of the west, and the snows of the north, without the slow travel, the long labour, and the torturing disease? Are we never to have the means of varying our climate even without passing from our own land; of shooting up from the fervours of a feverish summer into regions where no cloud intercepts the sun, and yet where eternal freshness reigns? Of meeting the morning, not in the mists of our heavy capitals, but in the rosy lights of the ethereal Aurora? Of resting above the mountains, and looking down with philosophic delight on the infinite variety of form, life, and beauty below? Of sailing in our meteorship among the world of meteors, and floating among the golden and vermillion canopies of that "great soldan," the sun, as he slumbers on the west? What a vast, various, and lovely increase to the enjoyments, the knowledge, and the social affections of man would be given by this power of rapid transit, beyond all the harsh restraints of human domination, the difficulties of space, and almost the expenditure of time! Yet, are we in a condition to be trusted with such a power? Might it not be turned into a dreadful means of hostility? Might it not pour conflagration on sleeping cities, bring sudden invasion, shed poison in all our streams, fling infection in all our fields, and exhaust us in perpetual vigilance, without hope and without use, until we deprecated the power and deplored the luckless day when man, wisely deprived of wings by nature, invested himself with this new and terrible faculty of mutual destruction? It is scarcely possible to conceive that so fine an invention as the balloon would have been placed in our hands to be for ever worthless; to tempt us by its apparent powers, and disappoint us by its real inutility. Or may not its perfection be reserved for that happier era when peace shall be felt to be the commanding policy as much as it is the true interest of all nations; when sacred wisdom shall be the unfailing guide of public council, and benevolent honesty, the great principle of empire? Then, and then alone, would there be an unmixed good in the possession of this noble instrument of communicating at will with all the people of the earth; in surmounting, with the ease of an eagle's wing, all the intervening barriers of mountain and desert; and with a still more prolonged and productive flight, passing over oceans, and conveying to the ends of the earth, the knowledge, the charities, and the sympathies of the great family of man.

In the mean time the steam-carriage, that earthly balloon, is preparing to take a higher character for speed. The London and Bris-

tish Railway Company have announced that they will sweep over hill and dale at the rate of forty miles an hour. And it is stated by some of our engineers, that this is but a *mitigated* speed; that twice the velocity might be easily obtained; and that in fact, there is no limit but the weakness of the materials to the rapidity communicable to the engine. It is to be presumed also, that in a period when railways are stretching over every county of England, and the minds of all scientific men are fixed almost wholly on the powers of steam, discoveries will be made in rendering those powers more applicable; that not merely greater velocity, but less expense, will be among the results; and, as the consequence, that the steam-carriage will be brought within the means of private life. This would, indeed, open a vast access of pleasure, profit, and power to mankind; almost extinguish distance; give the humbler classes of society a means of movement in every direction, of health, indulgence, or business; relieve man of the chief part of those toils which now, instead of invigorating, wear down the frame; save the enormous expense, waste, and trouble of cattle for labour; assist largely in cultivating the soil; and, by making every corner of our fine country accesible to all at will, would, in a few years, turn England into a garden, and, if the minds of men were capable of being softened by the bounties of heaven, that garden into a paradise.

REPORT OF MR. RAUB'S STEAM-GAUGE.

(From the *Journal of the Franklin Institute.*)

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination Mr. Raub's Steam-gauge Report:—

That Mr. Raub's steam-gauge consists of a safety-valve or piston, differing in no essential feature from ordinary safety-valves, except that there is connected with it, by means of a lever, a weight, suspended in the water of the boiler, in such manner that when the water gets below a certain point, at which the weight is placed, the increased power of the weight, arising from its losing the support of the water, assists in opening the safety-valve.

The practical effect is this:—If the safety-valve is so graduated that steam will be blown off at a certain pressure, say seventy-five pounds to the inch, when the boiler is properly filled with water, it will escape at a lower pressure, say fifty or sixty pounds to the inch, according to the dimensions of the weight, when the water is too low. In this way it is proposed to avoid the explosions, or other evil effects which might arise from a portion of the boiler becoming bare of water and heated to a higher degree.

The principle of which the weight acts, is like that of the floats which have been heretofore used, to show the height of water in the boiler, except that the weight in Mr. Raub's machine is connected with the ordinary safety-valve, and the steam is blown off in large quantities when the water is too low, instead of a simple alarm being sounded.

The question for the consideration of the Committee is whether this combination is advantageous. It is a matter of doubt, whether the blowing off of a quantity of steam when the water is deficient in the boiler, is not pernicious, as tending still more to exhaust the water; and whether the old application of the float to regulate the supply of water is not better. Waving these questions, however, it appears evident to the Committee that if a weight or float is to be used to cause the escape of steam, when the water is too low, it is better to have it attached to a separate valve, instead of being connected with the ordinary safety-valve; because on the latter plan it will not operate when the steam is at a low density or pressure, although the water be deficient; and because when it does operate, the engineer cannot know whether its action is in consequence of the water being too low, or the steam too high. Hence the advantages usually anticipated from the use of floats, cannot be realised from this machine.

Whether floats or weights can safely be relied on for showing the low state of the water in the boiler, and for obviating its effects, is a question of experience which it is unnecessary here to discuss, inasmuch as Mr. Raub does not claim to have originated them, but to have made an improvement in their application: and for the reasons above stated, the Committee are not satisfied that his steam-gauge, in its present form, will be found practically advantageous.

By order of the Committee,

WILLIAM HAMILTON, Actuary.

May 12, 1836.

NOTES AND NOTICES.

Sinking Bottles in the Ocean.—During my former voyage to South Africa, we sank wine bottles fifty fathoms into the sea, after they had been secured from the admission of water in the best manner we could devise, by covering the corks with resin, which led some to imagine that part of the fluid had entered by the pores of the glass; and some persons even supposed the water might there-

by be divested of its saline particles. To settle these points, a friend had presented me with two crystal globular bottles, hermetically sealed, and made on purpose. In latitude 14 degrees north, 27 minutes to the westward of the Cape de Verd Islands, these and some other bottles were sunk, by permission of Captain Creery of the *Westmoreland*, bound for Bombay, 200 perpendicular fathoms, by means of two leads, the one weighing 22lbs. and the other 28lbs. To pull up this great length of rope and weight of lead, required the exertion of ten men for a quarter of an hour. On the two globular bottles being brought on deck, they were found empty; but a wine bottle sent down at the same time, corked and plastered over with resin, came up full of water, with the cork inverted. This we could not mistake, as the head was covered with red wax, previous to the application of the resin, and upon its reaching the deck it was indeed still corked, but the waxed end was undermost in the neck of the bottle. Another wine-bottle had the pitch remaining entire on its mouth, but the inside was nearly full of water, in which also the cork was swimming. Two other bottles were full of water, but the corks and resin of these were in the same state as when let down. The water in the inside was not fresher than before its entrance.—*Campbell's Second Journey in South Africa.*

Interesting to Blacksmiths.—Permit me to describe a machine which I have just seen, and which, for utility and simplicity, is truly admirable. The article I allude to is a substitute for a smith's bellows, and is far more powerful than the kind in common use. It is constructed in the way of fanners, and stands immediately behind the forge. The box of the implement is only eighteen inches diameter, and the fans which fill the box are only five inches broad, and are fastened upon a horizontal shaft of ¾-inch iron. On the end of the shaft is a pulley two inches diameter, and right above which is a larger pulley twenty inches diameter, with a crank in the centre, which the man at the fire drives with one hand, while he guides the iron in the fire with the other. Around the large pulley and down to the small one is a leathern belt, by which this machine is driven, and with such ease that a child may drive it. The blast is so constant and so efficient, that the contriver prefers it for heavy work to the best bellows, which cost him 6*l.*, while he has the blast-bellows for about 30*s.*; and he adds, that, for a few more shillings, he could have it driven by wind. Although bellows on the same plan have been used and driven by steam and by water at our large iron-works, yet the merit of constructing one to work with the hand, belongs to Mr. William Bowie, blacksmith, Lower Bridge-street, Stirling. What adds much to the value of this contrivance is, its being easily purchased, that it requires little room, and is in many respects superior to the kind in common use. I hope, therefore, the sons of Vulcan will duly appreciate the contrivance.—*Correspondent of the Stirling Journal.*

Mr. John Louden M'Adam, the celebrated road-maker, died on the 26th November, in his eighty-first year. The *Dumfries Courier* gives the following particulars of Mr. M'Adam, his family, and fortune:—"Mr. M'Adam has left a widow and two or more sons by his first marriage, upon one of whom was conferred the title of Knighthood, which the father declined on account of his age and growing infirmities. In manner and address no man could be more agreeable; in place of being a mere road-maker, he was a man of science generally, conversed most intelligently on almost every subject, kept pace with the advancing knowledge of the age, and composed with all the accuracy of a professed littérateur. From Government he received, in two different instalments, ten thousand pounds—a very slender reward, indeed, considering the vast utility of the improvement he originated. He was not rich; but he has left behind him what is better than money—a name which is as familiar as a household word."

Mr. Mackintosh's Essay at Perpetual Motion.—Sir, The result of Mr. Mackintosh's essay at perpetual motion might be attributed to the avoidable friction caused by the manner in which the iron ball is placed in the wheel. Curious to try the experiment, I proceeded, and, with the view of diminishing the friction, I placed two wheels on the axis of the ball, but the result was precisely that described by Mr. Mackintosh. I next applied the *ratchet* as suggested, but with no better effect; the ball rolled towards the magnet, but did not give the required motion to the wheel. It is not unlikely, then, that the present ingenious attempt will not be realised.—I remain, Sir, ROBERT MUNRO, Nov. 3, 1830.

Sir,—In No. 689 of the *Mechanics' Magazine* your ingenious correspondent, Colonel Macerone, makes mention of some cosmolithes or meteoric stones found in *Kent*: would he be kind enough to state if they resemble in composition those preserved in collections of minerals, and which have been seen to fall in different parts of the world, containing nickel, cobalt, &c.? Being something of a mineralogist and chemist, I should like to procure a specimen if it can be purchased.—CONSTANT READER.

Marine Insurance.—The system of marine insurance, though affording the means of protecting individuals from excessive loss, has nevertheless a tendency, by transferring the pecuniary responsibility for such losses from the owners of ships to the underwriters who insure them, to induce less care in the construction of ships, less efficiency in their equipment, and less security for their adequate management at sea; inasmuch as the risk of such loss to the shipowners can be covered by a fixed premium of insurance, which being charged on the freight, and then re-charged on the goods conveyed, fixes the real responsibility and real loss ultimately on the public; as all the parties actually engaged in the transaction can secure themselves from any participation in such loss by the aid of marine insurance.—*Report of Commons' Committee on Shipwrecks.*

The Supplement to Vol. XXV., containing Title, Table of Contents, Index, and Plate of Specimens of English Medallic Engraving by Mr. Bate, was published on the 1st of December, price 6*d.*

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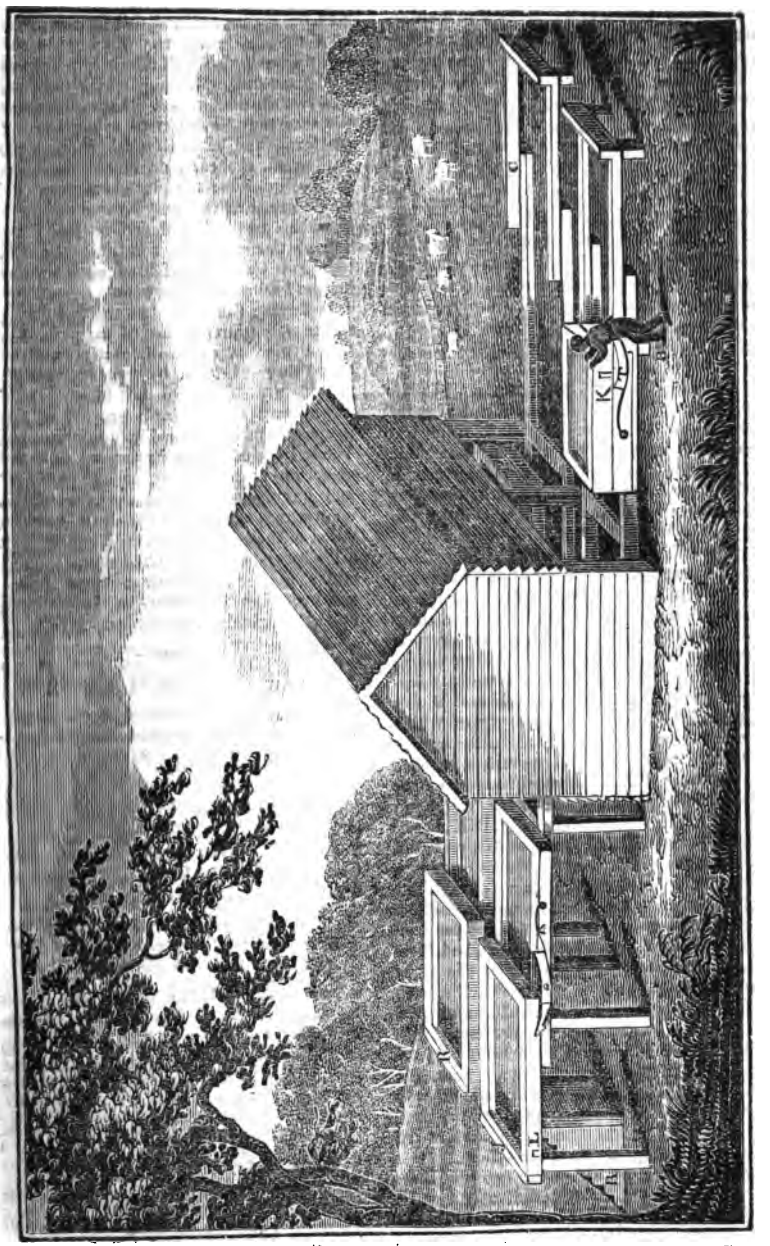


PHILBRICK'S PATENT APPARATUS FOR DRYING COTTON.

PHILBRICK'S PATENT APPARATUS FOR DRYING COTTON.

At the present time, when exertions are making to extend the cotton plantations of the British Colonies, whatever presents facilities to the after processes, must be acceptable to the planter. Since the opening of the East India trade, it has been shown that the British cotton-manufacturer might be supplied from that quarter alone, and with an article of a superior description to that which is at present imported from Georgia or the Carolinas. We hope, therefore, that the following description of a new method of drying cotton, patented in America, and which we extract from the *Franklin Journal* for September last, will be useful and interesting to our Colonial readers.

"I have invented (says the patentee in his specification,) an apparatus for drying of cotton after it has been picked from the plant, and of a great variety of vegetable and other substances which require exposure to the sun and air; and by which apparatus they may be immediately protected from the effects of rain and storms.

"The following is a description thereof:—I erect a staging, consisting of parallel rails, which are to support platforms, troughs, or cars, upon which the cotton or other articles dried are to be spread. These cars or platforms may be of any convenient dimensions, but for the sake of description, we will suppose them to be made 5 feet wide and 8 feet long, and the wheels or rollers upon which they run to be 6 inches high. In the accompanying drawing, one of these rails is marked with the letter C, and rises 6 inches, or the height of the platform above the rail upon which it reclines at its left end. P, B, K, L, are platforms, troughs, or cars, which rest and run upon the rails, having wheels or rollers upon their undersides for that purpose. The rails upon which the platforms rest, rise one above the other in the form of steps, as seen in the drawing; the platform marked K is represented as having passed from the right hand on to the next platform, having been pushed forward by the man H, and now stands upon a platform on the next rail, against which it catches, and both pass together under the shed in the centre, the pair, marked P, being shown as already there. Those at the left hand of the shed are to be slid in, in the same way, when necessary, and pass above the others. I is a latch, or catch, by which the two platforms are held together, or released, at pleasure. B are moveable steps, for conveniently reaching, charging, and discharging the platforms.

"Although two only of such platforms are represented as extending on each side of the shed, the number to be used is limited only by the convenience with which they may be managed; and this is the case also with their dimensions. The mode of managing them also, will admit of being varied, whilst the principle upon which they operate will remain unchanged. Thus, for example, the shed may be made to cover the highest platform, and be itself pushed on, so as to gather all the cars, or platforms, under it, in its progress; the platforms may be in a single row, or there may be two or more rows in width, two being shown in the drawing. The platform may be run under the shed by hand, or by means of a winch with a windlass and ropes, or otherwise.

"Having thus fully exemplified the general construction and use of my said apparatus, I wish it to be distinctly understood that I do not intend, by the examples given, to limit myself thereto, but to vary the same in any way I may think proper, whilst the proposed end is attained by analagous means. What I claim as my invention, is the construction of a railway, in successive steps, and having upon them cars, or platforms, upon which articles to be dried may be exposed to the sun and air, and which may, in a few seconds, be deposited upon each other under a shed, to protect them from the weather when necessary, in the manner, or upon the principle, herein set forth."

NEW AMERICAN PATENT LAW.

[In our 674th Number we inserted the Bill proposed to Congress for the Amendment of the American Patent Law. This Bill, with some alterations, has since passed into an Act; we, therefore, now give the clauses in which any alteration has been made—the parts inserted by the Congress being in italics, and those omitted, between brackets.]

An Act to Promote the Progress of Useful Arts, and to Repeal all Acts and Parts of Acts heretofore made for that Purpose.

Be it enacted, by the Senate and House of Representatives of the United States of America in Congress assembled, that there shall be established and attached to the Department of State, an office to be nominated the Patent Office; the chief officer of which shall be called the Commissioner of Patents, to be appointed by the president, by and with the advice and consent of the Senate, whose duty it shall be, under the direction of the Secretary of State, to superintend, execute, and perform, all such acts and things touching and respecting the granting and

issuing of patents for new and useful discoveries, inventions, and improvements, as are herein provided for, or shall hereafter be, by law, directed to be done and performed, and shall have the charge and custody of all the books, records, papers, models, machines, and all other things belonging to said office. And said Commissioner shall receive the same compensation as is allowed by law to the Commissioner of the Indian Department, *and shall be entitled to send and receive letters and packages by mail, relating to the business of the office, free of postage.*

Sec. 2. And be it further enacted, That there shall be, in said office, an inferior officer, to be appointed by the said principal officer, with the approval of the Secretary of State, *to receive an annual salary of seventeen hundred dollars*, and to be called the Chief Clerk of the Patent-office; who, in all cases during the necessary absence of the Commissioner, or when said principal office shall become vacant, shall have the charge and custody of the seal, and of the records, books, papers, machines, models, and all other things belonging to the said office, *and shall perform the duties of Commissioner during such vacancy.* And the said Commissioner may also, with like approval, appoint *an examining clerk, at an annual salary of fifteen hundred dollars;* two other clerks *at twelve hundred dollars each*, one of whom shall be a competent draughtsman; one other clerk at one thousand [250] dollars; a machinist at twelve hundred *and fifty* dollars; and a messenger at *seven hundred* [500] dollars. *And said Commissioner, clerks, and every other person appointed and employed in said office, shall be disqualified and interdicted from acquiring or taking, except by inheritance, during the period for which they shall hold their appointments, respectively, any right or interest, directly or indirectly, in any patent for an invention or discovery, which has been, or may hereafter be, granted.*

Sec. 3. And be it further enacted, That the said principal officer, and every other person to be appointed in the said office, shall, before he enters upon the duties of his office or appointment, make oath or affirmation, truly and faithfully to execute the trust committed to him. And the said Commissioner and the chief clerk shall also, before entering upon their duties, severally give bonds with sureties to the Treasurer of the United States, *the former in the sum of ten thousand dollars, and the latter, in the sum of five thousand dollars*, with condition to render a true and faithful account to him or his successor in office, quarterly, of all moneys which shall be by them respectively received for duties on patents, and for copies of records and drawings, and all other monies received by virtue of said office.

[Sections 4 and 5 not altered].

Sec. 6. And be it further enacted, That any person or persons having discovered or invented any new and useful art, machine manufacture, or composition of matter, or any new and useful improvement on any art, machine, manufacture, or composition of matter, not known or used by others before his or their discovery or invention thereof, and not, at the time of his application for a patent, in public use or on sale, with his consent or allowance, as the inventor or discoverer, and shall desire to obtain an exclusive property therein, may make application in writing to the Commissioner of Patents, expressing such desire, and the Commissioner, on due proceedings had, may grant a patent therefor. But before any inventor shall receive a patent for any such new invention or discovery, he shall deliver a written description of his invention or discovery, and of the manner and process of making, constructing, using, and compounding the same, in such full, clear, and exact terms, avoiding unnecessary prolixity, as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, compound, and use the same; and in case of any machine, he shall fully explain the principle and the several modes in which he has contemplated the application of that principle or character by which it may be distinguished from other inventions; and shall particularly specify and point out the part, improvement, or combination, which he claims as his own invention or discovery. He shall, furthermore, accompany the whole with a drawing or drawings, and written references, where the nature of the case admits of drawings, or with specimens of ingredients, and of the composition of matter, sufficient in quantity for the purpose of experiment, where the invention or discovery is of a composition of matter; which descriptions and drawings, signed by the inventor and attested by two witnesses, shall be filed in the Patent-office; and he shall, moreover, furnish a model of his *invention* [machine], in all cases which admit of a representation by model, of a convenient size to exhibit advantageously its several parts. The applicant shall also make oath or affirmation that he does verily believe that he is the original and first inventor or discoverer of the art, machine, composition, or improvement, for which he solicits a patent, and that he does not know or believe that the same was ever before known or used; *and also of what country he is a citizen;* which oath or affirmation may be made before any person authorised by law to administer oaths.

Sec. 7. And be it further enacted, That, on the filing of any such application, de-

scription, and specification, and the payment of the duty hereinafter provided, the Commissioner shall make or cause to be made, an examination of the alleged new invention or discovery; and if, on any such examination, it shall not appear to the Commissioner that the same had been *invented or discovered by any other person in this country*, [known and used] prior to the alleged invention or discovery thereof by the applicant, or that it had been *patented or described in any printed publication in this or any foreign country, or had been* in public use or on sale with the applicant's consent or allowance prior to the application; if the Commissioner shall deem it to be sufficiently useful and important, it shall be his duty to issue a patent therefor. But whenever, on such examination, it shall appear to the Commissioner that the applicant was not the original and first inventor or discoverer thereof, or that any part of that which is claimed as new had before been *invented or discovered, or patented, or described in any printed publication in this or any foreign country* [known and used], as aforesaid, or that the description is defective and insufficient, he shall notify the applicant thereof, giving him, briefly, such information and references as may be useful in judging of the propriety of renewing his application, or of altering his specification to embrace only that part of the invention or discovery which is new. In every such case, if the applicant shall elect to withdraw his application, relinquishing his claim to the model, he shall be entitled to receive back *twenty* dollars, part of the duty required by this Act, on filing a notice in writing of such election in the Patent-office, a copy of which, certified by the Commissioner, shall be a sufficient warrant to the treasurer for paying back to the said applicant the said sum of *twenty* dollars. But if the applicant in such case shall persist in his claim for a patent, with or without any alteration of his specification, he shall be required to make oath or affirmation anew, in manner as aforesaid. And if the specification and claim shall not have been so modified as, in the opinion of the Commissioner, shall entitle the applicant to a patent, he may, on appeal, and upon request in writing, have the decision of a Board of Examiners, to be composed of three disinterested persons, who shall be appointed for that purpose by the Secretary of State, *one of whom, at least, to be selected, if practicable and convenient, for his* [and to be selected for their] knowledge and skill in the particular art, manufacture, or branch of science to which the alleged invention appertains; who *shall be under oath or affirmation for the faithful and impartial performance of the duty imposed upon them by said appointment. Said board* shall be furnished with a certificate in writing, of the opinion and decision of the Commissioner, stating the particular grounds of his objection, and the part or parts of the invention which he considers as not entitled to be patented. And the said board shall give reasonable notice to the applicant, as well as to the Commissioner, of the time and place of their meeting, that they may have an opportunity of furnishing them with such facts and evidence as they may deem necessary to a just decision; and it shall be the duty of the Commissioner to furnish to the board of examiners such information as he may possess relative to the matter under their consideration. And on an examination and consideration of the matter by such board, it shall be in their power, or of a majority of them, to reverse the decision of the Commissioner, either in whole or in part, and their opinion being certified to the Commissioner, he shall be governed thereby, in the further proceedings to be had on such application: Provided, however, That before a board shall be instituted in any such case, the applicant shall pay to the credit of the Treasury, *as provided in the ninth section of this Act*, the sum of *twenty-five dollars; and each of said persons so appointed shall be entitled to receive for his services in each case, a sum not exceeding ten dollars, to be determined and paid by the Commissioner out of any monies in his hands*, which shall be in full compensation to the persons who may be so appointed, for their examination and certificate as aforesaid.

Sec. 8. And be it further enacted, That whenever an application shall be made for a patent, which, in the opinion of the Commissioner, would interfere with any other patent for which an application may be pending, or with any unexpired patent, which shall have been granted, it shall be the duty of the Commissioner to give notice thereof to such applicants, or patentees, as the case may be; and if either shall be dissatisfied with the decision of the Commissioner on the question of priority of right or invention, on a hearing thereof, he may appeal from such decision, on the like terms and conditions as are provided in the preceding section of this Act; and the like proceedings shall be had, to determine which or whether either of the applicants is entitled to receive a patent as prayed for. *Provided nothing in this Act contained shall be construed to deprive an original and true inventor of the right to a patent for his invention, by reason of his having previously taken out letters patent therefor in a foreign country; and the same having been published, at any time within six months next preceding the filing of the specification and drawing. And whenever the applicant shall request it, the patent shall take date from the time of the filing of the specifications and drawings, not*

however exceeding six months prior to the actual issuing of the patent; and on like request, and the payment of the duty herein required, by any applicant, his specification and drawings shall be filed in the secret archives of the office, until he shall furnish the model and the patent be issued, not exceeding the term of one year, the applicant being entitled to notice of interfering applications.

Sec. 9. And be it further enacted, That before any application for a patent shall be considered by the Commissioner as aforesaid, the applicant shall pay into the Treasury of the United States, or into the Patent-office, or into any of the deposit-banks to the credit of the Treasury, if he be a citizen of the United States, or an alien, and shall have been a resident in the United States for one year next preceding, and shall have made oath of his intention to become a citizen thereof, the sum of *thirty* [40] dollars; if a subject of the King of Great Britain, the sum of five hundred dollars; and all other persons the sum of three hundred dollars; for which payment duplicate receipts shall be taken, one of which to be filed in the office of the Treasurer. And the monies received into the Treasury under this Act, shall constitute a fund for the payment of the salaries of the officers and clerks herein provided for, and all other expenses of the Patent-office, and to be called the patent-fund.

[Section 10 unaltered.]

Sec. 11. And be it further enacted, That every patent shall be assignable in law, either as to the whole interest, or any undivided part thereof, by any instrument in writing; which assignment, *and also every grant and conveyance of the exclusive right under any patent, to make and use, and to grant to others to make and use, the thing patented within and throughout any specified part or portion of the United States*, shall be recorded in the Patent-office within three months from the execution thereof, for which the assignee or grantee shall pay to the Commissioner the sum of *three* dollars.

Sec. 12. And be it further enacted, That any citizen of the United States, or alien, who shall have been a resident in the United States one year next preceding, and shall have made oath of his intention to become a citizen thereof, who shall have invented any new art, machine, or improvement thereof, and shall desire further time to mature the same, may on paying to the credit of the Treasury, in manner as provided in the ninth section of this Act, the sum of twenty dollars, file in the Patent-office a caveat, setting forth the design and purpose thereof, and its principal and distinguishing characteristics, and praying protection of his right, till he shall have matured his invention; which sum of twenty dollars, in case the person filing such caveat shall afterwards take out a patent for the invention therein mentioned, shall be considered a part of the sum herein required for the same. And such caveat shall be filed in the confidential archives of the office, and preserved in secrecy. And if application shall be made by any other person within one year from the time of filing such caveat, for a patent of any invention with which it may in any respect interfere, it shall be the duty of the Commissioner *to deposit the description, specifications, drawings, and model, in the confidential archives of the office, and to* give notice, *by mail*, to the person filing the caveat, of such application, who shall, within three months after receiving the notice, if he would avail himself of the benefit of his caveat, file his description, specifications, drawings, and model; and if, in the opinion of the Commissioner, the specifications of claim interfere with each other, like proceedings may be had in all respects as are in this Act provided in the case of interfering applications: Provided, however, That no opinion or decision of any board of examiners, under the provisions of this Act, shall preclude any person interested in favour of or against the validity of any patent which has been or may hereafter be granted, from the right to contest the same in any judicial court in any action in which its validity may come in question.

[No material alteration in Section 13.]

Sec. 14. And be it further enacted, That whenever, in any action for damages for *making*, using, or selling the thing whereof the exclusive right is secured by any patent heretofore granted, or by any patent which may hereafter be granted, a verdict shall be rendered for the plaintiff in such action, it shall be in the power of the court to render judgment for any sum above the amount found by such verdict as the actual damages sustained by the plaintiff, not exceeding three times the amount thereof, according to the circumstances of the case, *with costs*; and such damages may be recovered by action on the case, in any court of competent jurisdiction, *to be brought in the name or names of the person or persons interested, whether as patentee, assignees, or as grantees of the exclusive right within and throughout a specified part of the United States.*

Sec. 15. And be it further enacted, That the defendant in any such action shall be permitted to plead the general issue, and to give this Act and any special matter in evidence, of which notice in writing may have been given to the plaintiff or his attorney, thirty days before trial, tending to prove that the description and specification filed by plaintiff does not contain the whole truth relative to his invention or discovery, or that it contains more than is necessary to produce

the described effect; which concealment or addition shall fully appear to have been made for the purpose of deceiving the public, or that the [patentee was not the original and first inventor or discoverer of the] thing patented, *or of a substantial or material part thereof claimed as new*, or that it had been described in some public work anterior to the supposed discovery thereof by the patentee, or had been in public use, or on sale with the consent and allowance of the patentee before his application for a patent, or that he had surreptitiously or unjustly obtained the patent for that which was, in fact, invented or discovered by another, *who was using reasonable diligence in adapting and perfecting the same;* or that the patentee, if an alien at the time the patent was granted, had failed and neglected for the space of eighteen months from the date of the patent, to put [in operation and use in the United States] and continue on sale to the public, on reasonable terms, the invention or discovery for which the patent was issued [or in case the same, for any period of eighteen months after it shall have been put in operation and use, shall cease to be so used or put on sale], in either of which cases judgment shall be rendered for the defendant, with costs. *And whenever the defendant relies in his defence on the fact of a previous invention, knowledge, or use of the thing patented, he shall state, in his notice of special matter, the names and places of residence of those whom he intends to prove to have possessed a prior knowledge of the thing, and where the same had been used: Provided, however, that whenever it shall satisfactorily appear that the patentee, at the time of making his application for the patent, believed himself to be the first inventor or discoverer of the thing patented, the same shall not be held to be void on account of the invention or discovery or any part thereof having been before known or used in any foreign country, it not appearing that the same or any substantial part thereof had before been patented or described in any printed publication.* And provided, also, that whenever the plaintiff shall fail to sustain his action on the ground that in his specification of claim is embraced more than that of which he was the first inventor, if it shall appear that the defendant had used or violated any part of the invention justly and truly specified and claimed as new, it shall be in the power of the court to adjudge and award as to costs as may appear to be just and equitable.

Sec. 16. And be it further enacted, That whenever there shall be two interfering patents, or whenever a patent on application shall have been refused on an adverse decision of a board of examiners, on the ground that the patent applied for would interfere with an unexpired patent previously granted, any person interested in any such patent, either by assignment or otherwise, in the one case, and any such applicant in the other case, may have remedy by bill in equity; and the court having cognizance thereof, on notice to adverse parties and other due proceedings had, may adjudge and declare either the patents void in the whole or in part, *or inoperative and invalid in any particular part or portion of the United States, according to the interest which the parties to such suit may possess in the patent or the inventions patented,* and may also adjudge that such applicant is entitled, according to the principles and provisions of this Act, to have and receive a patent for his invention, as specified in his claim, or for any part thereof, as the fact of priority of right or invention, shall in any such case be made to appear. And such adjudication, if it be in favour of the right of such applicant, shall authorise the Commissioner to issue such patent, on his filing a copy of the adjudication, and otherwise complying with the requisitions of this Act. Provided, however, that no such judgment or adjudication shall affect the rights of any person except the parties to the action and those deriving title from or under them subsequent to the rendition of such judgment.

[Section 17 unaltered. The following section is entirely new.]

Sec. 18. *And be it further enacted, That whenever any patentee of an invention or discovery shall desire an extension of his patent beyond the term of its limitation, he may make application therefore in writing to the Commissioner of the Patent-office, setting forth the grounds thereof; and the Commissioner shall, on the applicant's paying the sum of forty dollars to the credit of the Treasury, as in the case of an original application for a patent, cause to be published, in one or more of the principal newspapers in the city of Washington, and in such other paper or papers as he may deem proper, published in the section of country most interested adversely to the extension of the patent, a notice of such application, and of the time and place when and where the same will be considered, that any person may appear and show cause why the extension should not be granted. And the Secretary of State, the Commissioner of the Patent-office, and the Solicitor of the Treasury, shall constitute a board to hear and decide upon the evidence produced before them both for and against the extension, and shall sit for that purpose at the time and place designated in the published notice thereof. The patentee shall furnish to said board a statement, in writing, under oath, of the ascertained value of the invention, and of his receipts and ex-*

penditures, sufficiently in detail to exhibit a true and faithful account of loss and profit in any manner accruing to him from and by reason of said invention. And if, upon a hearing of the matter, it shall appear to the full and entire satisfaction of said board, having due regard to the public interest therein, that it is just and proper that the term of the patent should be extended, by reason of the patentee; without neglect or fault on his part, having failed to obtain, from the use and sale of his invention, a reasonable remuneration for the time, ingenuity, and expense bestowed upon the same, and the introduction thereof into use, it shall be the duty of the Commissioner to renew and extend the patent, by making a certificate thereon of such extension, for the term of seven years, from and after the expiration of the first term; which certificate, with a certificate of said board of their judgment and opinion as aforesaid, shall be entered on record in the Patent-office; and thereupon the said patent shall have the same effect in law as though it had been originally granted for the term of twenty-one years. And the benefit of such renewal shall extend to assignees and grantees of the right to use the thing patented, to the extent of their respective interest therein: Provided, however, that no extension of a patent shall be granted after the expiration of the term for which it was originally issued.

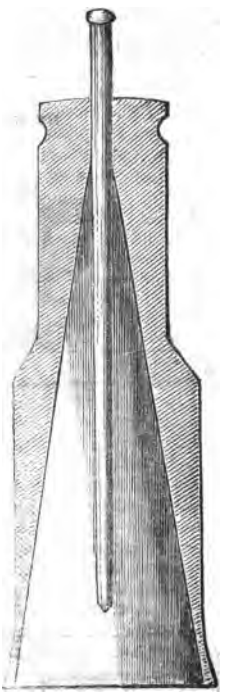
Sec. 19 [18]. And be it further enacted, That there shall be provided for the use of said office, a library of scientific works and periodical publications, both foreign and American, calculated to facilitate the discharge of the duties hereby required of the chief officers therein, to be purchased under the direction of the Committee of the Library of Congress. And the sum of *fifteen hundred* dollars is hereby appropriated for that purpose, to be paid out of the patent fund.

[Section 20 unaltered.]

Sec. 21 [20]. And be it further enacted, That all Acts and parts of Acts heretofore passed on this subject, be, and the same are hereby repealed: Provided, however, That all actions and processes in law or equity sued out prior to the passage of this Act, may be prosecuted to final judgment and execution, in the same manner as though this Act had not been passed, excepting and saving the application to any such action, of the provisions of the fourteenth and fifteenth sections of this Act, so far as they may be applicable thereto. *And provided, also, That all applications or petitions for patents, pending at the time of the passage of this Act, in cases where the duty has been paid, shall be proceeded with and acted on in the same manner as though filed after the passage thereof.*

JAMES K. POLK,
Speaker of the House of Representatives.
W. R. KING,
President of the Senate, *pro tem.*
Approved July 4. 1836.
ANDREW JACKSON.

UNIVERSAL CENTRE-PUNCH.



Sir,—The annexed drawing is a section of an universal centre-punch, which was contrived by me four years ago; but I have since been told that others have previously invented the same thing, which, from its extreme simplicity, is highly probable. Be this as it may, I have found it of great use in centering pieces of iron, &c. for turning between points in the lathe, or for finding a lost centre; and I therefore think it worthy of being more generally known, as will be seen from the drawing; it is merely a hollow cone terminating at the point in a small tube, which tube contains a cylindrical steel punch, *fitting* it *accurately*, and which is *truly* in the centre

of the cone; the cone is of iron. From its construction, it will immediately be seen that any piece of iron, &c., square, round, triangular, or of almost any shape, and of various sizes, may be in an instant centered by merely placing the instrument upon it and striking the punch. To insure accuracy in making the instrument, I may state that I used the following method:—Having first roughly turned a piece of iron *externally* into the shape required for the body of the instrument, I fixed it *firmly* by the small end in a chuck; I then drilled a hole directly through it—the *larger* end of the instrument running in a boring collar—this hole was then turned as far as necessary into a cone; a *clearing* bit was then passed through the hole to form the tube for the punch, which bit and punch were made from the *same* piece of *drawn polished* steel wire.

N. S. HEINEKEN.

Sidmouth, Nov. 17, 1836.

HEINEKEN'S ROSE-ENGINE CHUCK.

Fig. 1.

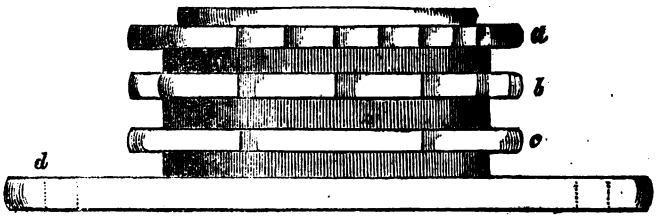
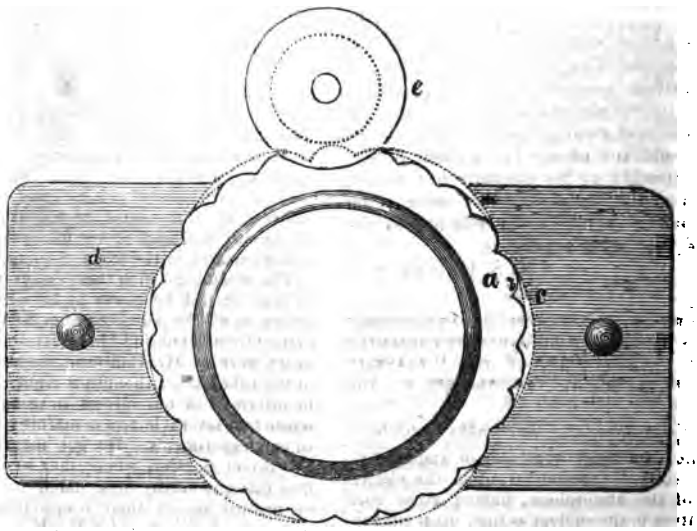


Fig. 2.



Sir,—The annexed figures, (fig. 1 being a side elevation, and fig. 2 a plan,) represent three small rose wheels, *a*, *b*, *c*, mounted upon a frame *d*; this frame is attached by two screws to the front of the lathe poppet—the mandril passing through the centre of the rose wheels. The eccentric chuck is to be screwed

upon the mandril; into the under part of the slide of the eccentric chuck is screwed a round pin, which passes through a slit in the foundation plate of the eccentric chuck, and is a little longer than the three rose wheels sent. The usual traversing screw of the eccentric chuck being removed, its slide will be free to move backwards and forwards. Now upon the above-named round pin is placed the small ivory rubber-wheel *e*, and which is contained between two thin plates or flanges of brass. This wheel is placed, at pleasure, upon any of the rose wheels; its brass flanges preventing it from shifting; a spring acting against the slide of the eccentric chuck keeps the rubber-wheel in contact with the rose wheels, and the lathe being put in motion, the figures will be produced by the usual application of the tools, in the slide rest, to the work. These figures might be made to assume an oval form also, by allowing the frame of rose wheels to be so fixed to the lathe as that they should be *eccentric* to the mandril. The position of the curves also may be varied by turning round the division plate of the eccentric chuck. The patterns produced by this contrivance differ from the rose-engine patterns in being at opposite points reversed, and in diminishing in curvature as the slide of the eccentric in its revolutions assumes a vertical position; thus, by simple means, adding a variety to the ornamental parts of the lathe.

Should the above be deemed of service, it will give me pleasure to forward, occasionally, descriptions of some other mechanical contrivances relating to the lathe, and other apparatus.

N. S. HEINEKEN.

HISTORY OF EXPERIMENTS ON ATMOSPHERIC ELECTRICITY, BEING A REPORT PRESENTED BY A COMMITTEE* OF THE "FRANKLIN KITE CLUB," AT THE REQUEST OF THE CLUB.

(From the *Journal of the Franklin Institute.*)

The Committee appointed to enquire into the history of experiments, upon the electricity of the atmosphere, having given such attention to the subject as their other engagements would allow, beg leave to submit the following report:—

The fact that amber and some gems, when excited by friction, possessed the curious property of attracting light bodies, was known to philosophers several centuries before the christian era. Nothing further, however, than this simple fact, seems to have been ascertained for the space of two thousand years.

The first modern experiments upon record were those of Dr. Gilbert, of Colchester, an account of which he published about the year 1600, in a Treatise de Magnete. Although several philosophers repeated the experiments of Gilbert, and somewhat augmented the list of electric substances, no discovery of importance was effected until about the year 1670, at which period Otto Guericke, celebrated as the inventor of the air-pump, constructed the first electrical machine of which we have any account, and acquired an additional title to renown, by discovering the light and sound by which the electric fluid is accompanied.

The existence of electric light was observed shortly afterwards in England, by Dr. Wall, to whom also is due the honour of first suggesting the idea of a resemblance between electricity and lightning.

This resemblance was afterwards noticed by Mr. Stephen Gray, who flourished about the year 1730; and still later by the Abbe Nollet; but neither of them appears to have attempted any investigation of the subject. The complete solution of this interesting problem in electrical science was reserved for our venerated countryman, Franklin; who, at an early period of his investigations, became strongly impressed with the idea that lightning and electricity were identical. He accordingly drew up a statement of the principal points of resemblance between them, and suggested a plan for proving the truth of his theory, by elevating pointed conductors upon a lofty tower or spire. This paper, together with several others upon the same subject, he transmitted to his friend Mr. Collinson, of London, by whom they were communicated to the Royal Society.

The reception which these essays met with in that learned body was by no means flattering, as will be perceived from the following extract from Franklin's Memoirs:—"Obliged, as we were to Mr. Collinson, for the present of the tube, &c., I thought it right he should be informed of our success in using it, and wrote him several letters containing accounts of our experiments. He got them read in the Royal Society, where they were not at first thought worthy of so much notice as to be printed among their transactions. One paper which I wrote for Mr. Kinnersly, on the sameness of lightning and electricity, was read, but was laughed at by the connoiseurs." The papers being afterwards shown to Dr. Fothergill, he thought them of too much importance to be stifled, and advised the printing of them. They were

* John C. Cresson, Esq., Chairman.

accordingly published in a pamphlet form by Cave, a bookseller in London, with a preface by Dr. Fothergill. A copy of this pamphlet happening to fall in the hands of Buffon the naturalist, this eminent philosopher was so well satisfied of the justness of Franklin's views, that he determined on making the attempt to draw down lightning from the clouds. Accordingly, he raised an insulated rod of iron upon the tower of Montbar, and prevailed upon M. D'Alibard to prepare an apparatus for the same purpose at Marly La Ville, about six miles from Paris. This apparatus consisted of a pointed iron rod, about forty feet long and an inch in diameter, the lower extremity of which was brought into a sentry box, and insulated upon a table with glass feet. M. D'Alibard entrusted the charge of his apparatus to a man named Coiffier, who, having served fourteen years in the dragoons, was supposed to have sufficient courage for such an undertaking.

We have been thus particular in our description of this machine, because it was the first to receive a visit from the ethereal fire; and shall now proceed to give a narrative of that important event, extracted from a paper laid before the Royal Academy of Science, at Paris, three days after the occurrence. "On Wednesday, the 10th of May, 1752, between two and three o'clock in the afternoon, M. Coiffier, an old dragoon, whom I had entrusted to make observations in my absence, hearing a pretty loud clap of thunder, immediately flies to the machine, taking with him a vial in which was fixed a brass wire; on presenting the point of the wire to the rod, he sees a small brilliant spark issue from it, and hears a crackling noise; he takes a second spark stronger than the first, and with a louder noise! He calls his neighbours, and sends for M. Roulet, the Prior of Marly. The Prior runs with all his might, and the parishioners seeing his haste, imagine that poor Coiffier had been killed by the thunder; the alarm spread throughout the village, and the hail which succeeded did not prevent them from following their pastor.

"The honest ecclesiastic arrived at the machine, and seeing there was no danger tries the experiment himself, and takes some strong sparks. The hail storm was not more than a quarter of an hour in passing the zenith of our machine, and there was no more thunder after the first clap." As soon as the cloud had passed, and they could get no more sparks from the rod, the Prior despatched M. Coiffier with the following hasty letter:—

"I announce to you, sir, the fulfilment of your expectations; the experiment is complete. This day at twenty minutes after two in the afternoon, it thundered directly over Marly, the clap was pretty loud. The desire to please you, and curiosity, induced me at once to quit my arm chair, in which I was engaged reading. I was hastening to M. Coiffier, and met on the road a child whom he had despatched to call me, I redoubled my speed through a torrent of hail. Arriving at the spot where the rod was placed, I took a brass wire, and advancing it towards the rod, when within about an inch and a half, a small column of blueish flame with a smell like sulphur, sprung with wonderful quickness to the point of the wire, and occasioned a noise as if the rod had been struck with a key. I repeated the experiment at least six times in about five minutes, each experiment requiring about the time of a Pater and an Ave. I wished to continue them, but the action of the fire gradually abated, and at length ceased altogether. The stroke of thunder which had occasioned this event was not followed by any other, and the whole was terminated by a copious shower of hail.

"I was so engaged during the experiment, that receiving a blow upon my arm above the elbow, I could not tell whether it proceeded from the brass wire or the rod. I did not complain at the moment, but the pain continuing on returning home, I uncovered my arm in the presence of Coiffier, and we perceived a contusion around it, such as would be caused by a blow from the wire upon the bare skin. When returning with Coiffier, I met the curate, M. de Milley, and the schoolmaster, to whom I reported what had happened. They all three perceived a smell of sulphur, which increased as they approached me: this odour was also perceived by the servants before I said any thing to them about it.

"You have here, sir, a hasty recital, but it is correct and true, and I assure you that I am ready to testify to these facts on all occasions. Coiffier was the first to make the experiment, and he repeated it several times before he sent for me. If any other testimony besides his and mine is necessary, you can obtain it. Coiffier is in haste to depart. I am yours with respectful consideration.

"RAULET, Prior of Marly.

"May 10, 1752."

Immediately upon the announcement of M. D'Alibard's success, M. Delor, demonstrator of physic, at Paris, erected a bar of iron upon his dwelling for the purpose of repeating the experiment, and succeeded in procuring several sparks during a thunderstorm on the 18th day of May. On the 19th of the same month, Buffon obtained a similar result at Montbar.

Thus was Franklin's hypothesis verified in Europe, while its illustrious author was waiting for the erection of a spire at Philadelphia, by which he should be enabled to reach what

he supposed to be the proper region for experiment. At length he devised the simple expedient of using a common kite for the attainment of his object, and in June, 1752, about a month after the French discoveries, but before any report of them had reached America, he performed his celebrated experiment.

Although it may seem unnecessary to repeat in this place a narrative with which every school-boy is familiar, we shall, nevertheless, annex an account of this famous experiment, believing the omission would leave our report defective in a very essential point. The kite used by Franklin on this occasion, was made by extending a silk handkerchief upon two crossed sticks. To the upright stick was affixed an iron point.

The string was of hemp, except a small portion of the lower end, which was of silk: where the hempen string terminated a key was fastened. With this apparatus, on the approach of a thunder-storm, he repaired to an open field, accompanied by his son, to whom alone he had communicated his intention.

Having raised his kite, he placed himself under a shed, to avoid the rain and preserve the insulation of his silk cord. A thunder cloud passed over the kite, and no sign of electricity appeared. When, almost despairing of success, he observed the loose fibres of the string become erect, as if they were repelled. He now presented his knuckle to the key and received a strong spark; others succeeded even before the string was wet; but when the string was thoroughly wetted by the rain, he collected the electric fire in great abundance.

Franklin afterwards erected an insulated rod upon his house, by means of which he continued to investigate the subject for several years, in conjunction with his friend Mr. Kinnersly. The new field of discovery thus opened to the votaries of science, was speedily entered by a host of experimenters. Of these, it will be necessary to name only a few of the more prominent, whose experiments and discoveries embrace all that it is interesting to know.

In England, the first attempts to repeat these experiments, were made by Mr. Canton and Dr. Bevis; but owing to the unfavourable nature of the climate, or some defect in their apparatus, it was not until after numerous disappointments that they succeeded in obtaining some feeble indication of electricity. The most splendid experiments that have come under the notice of the Committee, were those made in France by M. De Romas, assessor of the Presidial of Nerac.* This gentleman made use of a kite which was seven feet five inches in height, and three feet in its greatest width, having above eighteen square feet of surface. The string was wrapped with copper wire somewhat after the manner of the base string of a violin.

On the 7th of June, 1753, at one o'clock, it thundered in the west; at half-past two M. De Romas had raised his kite with a cord 780 feet long, inclined at an angle of 45° nearly; so that the elevation of the kite was about 550 feet. To the lower end of the cord he tied a ribbon of silk about three and a half feet long; this was brought under cover of a pent-house, and was there fastened to a heavy stone. Near the junction of the cord and ribbon was suspended a tube of tin one foot long and an inch in diameter, from which the sparks were to be drawn.

He had prepared a discharging-rod with a glass handle twelve inches long, and provided with a brass chain of sufficient length to touch the ground when sparks were drawn from the tube. By means of the discharging-rod he at first obtained sparks as large as those produced by a good globe, and several of his assistants drew sparks with keys and with the naked finger. This performance continued about twenty-two minutes, when the electricity disappeared; the little black clouds from which it was procured having passed from the zenith of the kite. In about seven minutes the electricity reappeared, but was at first very feeble; it gradually increased, and sparks were drawn by the fingers, canes, and swords, of the spectators. M. De Romas now touched the tube with his knuckle, and received a terrible shock, such as he had never experienced from the Leyden vial charged by the best globes. Seven or eight of the bystanders having joined hands, received sparks which struck the feet of the fifth person. The storm now approached and increased in violence, not a drop of rain had fallen; but in the zenith of the kite and about 60° around it, there were black clouds, which indicated a great increase of electricity.

M. De Romas, therefore, thought proper to receive sparks only by the discharge, and in this manner drew several sparks more than two inches long and of proportionate thickness. After this, the electricity became so strong, that instead of sparks sheets of fire three inches long and three lines in diameter, flashed to the distance of more than a foot from the tube. At this time, when about three feet from the cord, he felt a sensation as if a spider's web was upon his face. He advised his assistants to keep at a greater distance, and himself retired about two feet; and when five feet from the cord, he again perceived the same sensation, and retired still further. M. De Romas now paused to observe what took place in the clouds above the kite; there was no lightning, almost no

* A full account of these experiments may be found in the *Memoirs de Savans Etrangers*, published by the French Academy.

thunder, and not any rain, the wind was west, and so strong that the kite rose about 100 feet higher than at first. Having cast his eyes upon the tin tube which was about three feet from the ground; he observed three straws about a foot long, and others four and five inches in length, standing erect upon the ground and dancing in a ring beneath the tube-like puppets. This little spectacle lasted about fifteen minutes, after which some drops of rain fell, and he again felt the spider web sensation, and heard a rustling noise like the sound of a small forge bellows. This was considered a warning of a new increase of electricity, and he cautioned his assistants to retire to a greater distance. Now came the last act of this magnificent drama, which M. de Romas says made him tremble. The longest straw was attracted by the tube, and then followed an explosion which some compared to the noise of a petard, and others to the sound of a large earthen jar dashed upon a pavement. The fire, which accompanied this explosion, had the form of a spindle eight inches long, and four or five lines in diameter. The straw, which had caused the explosion, followed the string of the kite, and was seen at the distance of forty or fifty toises going with great rapidity, alternately attracted and repelled, every attraction being accompanied by sheets of fire and continual explosions. During this part of the exhibition there was a strong smell of sulphur, and around the string there appeared a cylinder of permanent light three or four inches in diameter; which, it was supposed, would have appeared to be four or five feet in diameter if the experiment had been made at night. Shortly after this, the wind shifted to the east and the rain fell abundantly, followed by some hail, so that they were unable to keep the kite up any longer; as it fell, the string came in contact with a roof, the kite was made to rise again, and as soon as it was released from the roof, the person who held the string received such a violent blow in his hands that he was compelled to relinquish it. The string now became slack, and falling upon the feet of one of the assistants, he felt a concussion almost insupportable. On the 16th of August, 1757, M. de Romas, having again raised his kite with a cord more than 1000 feet in length, obtained results even more astonishing than those just narrated.

In a letter to the Abbé Nollet, giving an account of this experiment, he says, "Imagine to yourself sheets of fire nine or ten inches in length, and one inch in diameter, with a noise like the report of a pistol: in less than an hour I had certainly thirty flashes of these dimensions without counting a thousand others of seven feet and under."

The dangerous nature of these experiments was fearfully illustrated about this time, by an accident which created a deep sensation throughout the scientific world. Professor Richman, of St. Petersburg, being engaged in a treatise upon electricity, had erected upon his house an apparatus for observing the electrical condition of the atmosphere, during thunder storms. On the 6th of August, 1753, while attending the usual meeting of the Imperial Academy of Sciences, a little before noon he heard the sound of distant thunder, he hastened home, accompanied by Mr. Sokolow, engraver to the academy. Upon examining the electrometer which was attached to his apparatus, Richman remarked that the thread pointed to four degrees on the quadrant; and described to Mr. Sokolow, the dangerous consequences that might ensue if the electricity should increase to 45^0 or more. At this moment, while Mr. Richman was in a stooping posture, with his head about a foot distant from the rod, a globe of white and blue fire, about the size of a man's fist, appeared between the machine and Mr. Richman's head.

At the same time, a sort of steam or vapour arose which stupefied the engraver, and made him sink down, so that he could not remember to have heard the thunder, which was very loud.

As soon as Mrs. Richman heard the loud clap of thunder, she hastened to her husband's chamber, fearful of some bad consequences, and found him entirely lifeless, sitting upon a chest which happened to be placed behind him, and leaning against the wall.

After this unfortunate occurrence, electricians became more circumspect in experimenting upon an agent so dangerous and intractable. The phenomena of thunder storms having been investigated to a considerable extent, philosophers next directed their attention to observations upon the ordinary electrical condition of the atmosphere, and the changes to which it is subject. Experiments of this kind were prosecuted in America, by Mr. Kennersley, the friend and associate of Franklin; in France, by M. Le Monnier, and the Abbé Mazeas; in Switzerland, by M. De Saussure; and in England, by Mr. Cavallo, Mr. Read, and several others. But the labours of these philosophers, although of great value and interest, fall very far short of those achieved by Signior Beccaria, of Turin, who continued a series of accurate experiments through a period of twenty years.

The observations of this eminent philosopher were made in all kinds of weather, and every season of the year. He made use of a great variety of instruments, and employed numerous assistants, sometimes causing simultaneous observations to be made at several distant places. As the limits of this report will not allow a detailed account of the phenomena observed by all these philosophers, it is

deemed advisable to furnish a condensed statement of the general results, upon which most of the observers agree in a very satisfactory manner.

In calm, clear, dry weather, the electricity was always perceptible and invariably positive. It was more abundant in winter than in summer. During a rain it was generally negative, but it sometimes became positive while the rain was falling; and on some occasions these changes occurred several times in the course of a single storm.

In cloudy, damp, or windy weather, it was mostly positive, but feeble. The quantity always increased with the length and elevation of the conductor; insulated strings extended horizontally, sometimes gave strong indications of electricity; a cord, 1,500 Paris feet in length, extended across the river Po, was found to be as strongly electrified during a shower unattended by thunder, as a rod of metal had been during a thunder storm.

The latest of these experiments were made about the year 1791; since which period, the interesting phenomena brought to light by the discovery of galvanism, have so much engrossed the attention of philosophers, that the other branches of electrical science have been comparatively neglected.

As far as the committee have been able to extend their researches, it appears that the observers of atmospheric electricity, have confined their experiments to a region of comparatively very small elevation, none of them having attained a greater distance from the surface of the earth, than one thousand feet; and even the few who reached this height, made use of such imperfect conductors, as were not calculated to furnish accurate results. It therefore seems probable, that a course of experiments made with good conductors elevated to the height of ten or fifteen thousand feet, would furnish such an addition to our knowledge of this interesting subject, as would fully compensate the labour and expense necessary for their prosecution.

ON THE OPENING OF THE GREENWICH RAILWAY.

Sir,—On this day (Dec. 14, 1836,) the London and Greenwich Railway was opened by the Lord Mayor of London.

Amidst the multiplicity of railway projects, this event, although unquestionably the opening of a new era in the history of England, is in danger of passing by unheeded. I would, therefore, with your permission, offer a few observations on this important event, and also upon the future prospects which it opens to our view.

The change which railways are calculated to effect, not only in England but throughout the whole of Europe, is of a most extended and beneficial character. We have now a prospect, a cheering prospect, that at no distant day all the ends of the earth will meet, and that their meeting will be in peace;—we may now hope that the time is not far distant when men will beat their swords into steam-ploughs, and their spears into steam-carriages, that nation will meet nation in the spirit of peace and brotherhood, and that they will learn the art of war no more.

Sir, this is no day-dream: so sure as effect follows cause, so sure will this be the ultimate result of an extended railway communication. Viewing railway operations in this light, we cannot do otherwise than wish them "God speed."

But this exhilirating view of the great extension of peace, happiness, and civilisation, pleasing as it undoubtedly is, must not lead us away from the consideration of the subject in a mere worldly or commercial point of view. If wild projects are undertaken, having no rational prospect of success, such projects must have an injurious effect—they will act as a damper upon the public mind, and instead of urging forward, they will retard the above consummation which is so devoutly to be wished. It therefore behoves the Parliament and the public to keep a strict eye on railway projectors, to see that the public good or the interest of the proprietors is not sacrificed to partial or private considerations.

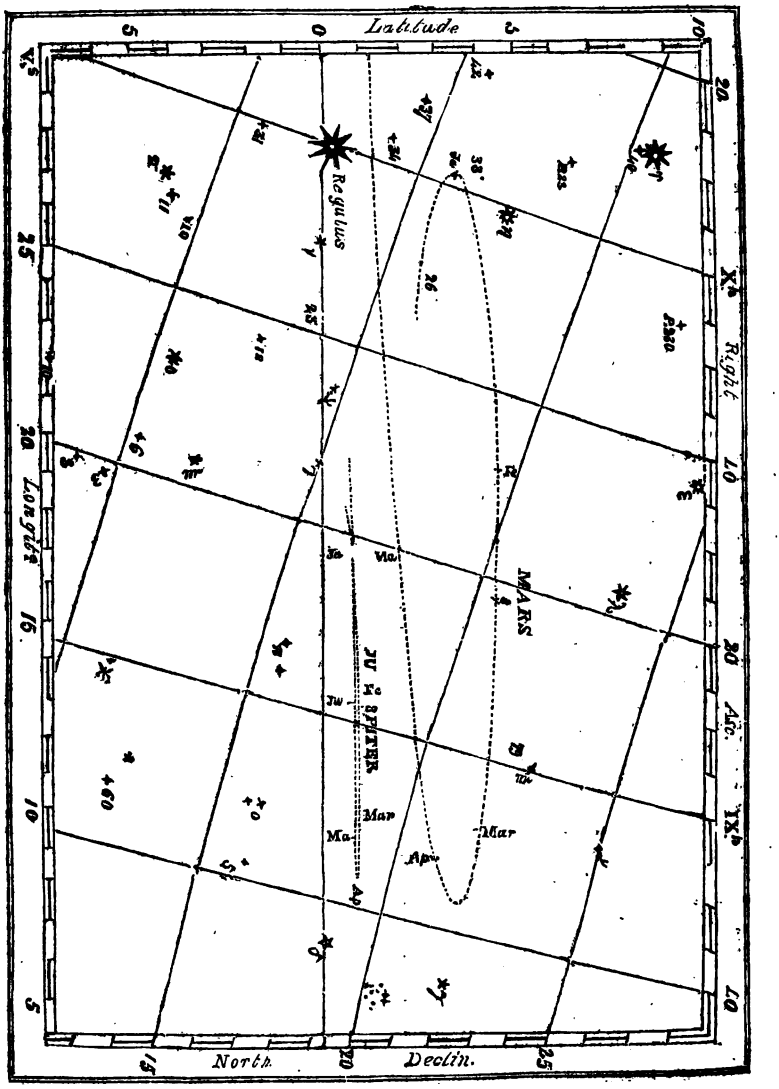
I hope the London and Greenwich Railway will return to the proprietors all that has been promised in the prospectus; but, that it may do so, they must follow a different plan than that which seems to guide their counsels at the present time. And, first, with respect to the arches. Why not make these a source of permanent profit at once? Why not convert them into *proper dwellings*, for which purpose they are much better adapted than the heads who direct the concern seem to suppose. A great deal of fuss was made some time back about the nuisance of the smoke from the chimneys annoying the passengers on the railway, and a "scientific stove" was procured which gave out no "carbon" (*Anglice*, soot) to annoy the olfactory nerves of the passengers steaming along with the huge chimney of the engine in front, pouring from its capacious throat immense volumes of the carboniferous perfume, to say nothing of the endless groves of chimney-pots of Bermondsey and Deptford. Now, I grant at once, that it would be an intolerable nuisance to have a row of chimney pots stuck along the top of the parapet wall, on a level with the carriages, just high enough to *whisk* the incense in at the carriage windows. But there is no need for this evil; the company have built a thousand houses, good substantial fire-proof houses, and having accomplished this, they can surely build a thousand chimnies high enough to carry the "carbon" over the heads of the passengers. As to the scientific stove that emits no smoke, I am sorely afraid that, as respects the interest of the proprietors, it will turn out to be altogether a bottle of smoke. A *fire in a box* might do very well on the banks of the Ganges, but will never suit the latitude of England. An Englishman likes "an Englishman's fireside," without which his house to his mind is not *a home*. There is no difficulty whatever in making these arches into comfortable homes, in which state they would yield to the Company a steady permanent return, and without this large auxiliary source of profit. I am apprehensive that after the novelty, the nine days' wonder of the thing has passed our heads, when every body has had a ride, that the receipts will fall considerably short of the estimate set forth in the prospectus.

I would further suggest the necessity of immediately establishing, especially at the London terminus, a regular communication with all parts of the town, by means of vans and omnibuses, so as to connect the railway with every part of London; the line of traffic is not so easily coaxed from its original channels. Judicious management is required; that this management will be applied and succeed, is the earnest wish of

Yours, &c.

Pentonville. GEORGE PONSFORD.

APPARENT PATHS OF MARS AND JUPITER, FROM 1ST DECEMBER, 1836, TO 31ST MAY, 1837.



Sir,—Your old favourite, Francis Moore, physician, in his Almanac for 1837, sets forth as follows:—

"At the commencement of the year, the two superior planets, Mars and Jupiter, have a slow retrograde motion, when the former

will be between *Regulus* and *Eta* in *Leo*, and the latter just leaving the upper part of the left paw of that constellation. *Jupiter* will also be in opposition to the Sun on the 2d, and *Mars* on the 6th of *February*. Moreover, these planets, by converse motion, will be in ecliptic conjunction on the 26th; *Mars* N. of *Jupiter* 3° 17′. On the 19th of March *Mars* becomes stationary, and afterwards direct; when, meeting *Jupiter*, he forms a second conjunction with that planet on the 28th, passing N. of Jove 2° 16′. After this they will gradually separate, and by the 26th of May *Mars* will again pass N. of *Regulus*, at about 1° from that star. Hence, during February and March, they will not only prove interesting objects for the telescope, but also for the naked eye."

In the propriety of these remarks I fully concur; and being also of opinion, that it must be difficult to form a correct idea of these phenomena without graphic assistance, I have formed a sketch* of the apparent paths of these planets, which is herewith submitted to your readers. Although it possesses little novelty†, I trust it will be found of considerable utility, there being no British celestial map extant on which the paths can be readily delineated, except the *enormous* sheets lately published by the Useful Knowledge Society, and even on these the representation would be a disjointed and incomplete one, in consequence of its falling near the borders of two maps, where the distortion is extremely perplexing.

When alluding to these maps, I feel much inclined (but forbear) to go into a long detail respecting them. They have been several years *on the anvil*, so that the public had imagined their appearance was altogether abandoned. Since I saw the proofs four years ago, many corrections and improvements have been made; and the maps have been ushered into the world under the care of Professor de Morgan, whose companion volume contains a great deal of valuable information on celestial maps generally, and the best apology for the inherent defects of the gnomonic projection that the subject will admit of. Still one cannot help regretting, that the talent and expense which, from first to last, have been bestowed upon this production, had not been expended upon a work of far greater convenience and practical utility.

I am, Sir,

Yours, &c.

J. W. Woollgar.

Lewes, 6th Dec., 1836.

* The projection is that of which the construction is explained in vol. xxi. p 339. The position of the planets are marked on the apparent orbits for the first of each month. The magnitudes of the stars are inferred by subtracting the number of rays from 10.

† My much respected friend, the author of "Evening Amusements," constantly inculcated the propriety of partial maps of this kind. He gave sketches of the paths of the three superior planets in many of his annual volumes. The phenomena of a conjunction of two bright planets very near to their opposites is of rare occurrence.

UNLOCOMOTIVE LECTURERS.

Another attempt has just been made by the Court of Common Council, to remove the Gresham Lectures from that snug corner, over the north-eastern gate of the Royal Exchange, to which they are so devotedly attached: for the very good reason, that its obscurity prevents their being very often annoyed by the presence of visitors. It was proposed, on the present occasion, to remove the scene of their labours to the New City of London Schools, on the site of Honey-lane Market; but, as on all previous occasions, the worthy Professors resolutely refused to move an inch, with one exception, in the person of Mr. Pullen, the recently elected Professor of Astronomy; and measures are now being taken to compel the unwelcome migration, if possible. The Professors allege, that they would be degraded by being attached to a mere school, and adduce, in proof of their great popularity, that the lectures, during the past year, have been attended by no fewer than 1,900 persons, out of the million and a half composing the population of London! Certes, the number does not appear *very* astonishing, when it is considered that, by Sir Thomas Gresham's will, there are to be two lectures read every day, during each term. It is high time that something should be done to render the establishment of some service. Whether that purpose would be *best* answered by a removal to the City of London School, may admit of question; but any thing is better than that matters should remain as they are.

ON PROPER AND IMPROPER PHILOSOPHICAL TERMS.

"Spirit of matter! beautiful beat!
Who bid'st atoms scatter, and then again meet!"*

Sir,—It has often been observed, and at the same time lamented, that in philosophical as well as in religious opinions, the great and fruitful source of controversy, may be traced to the vagueness of the terms which are set forth to represent or embody the principles under consideration. The Stoics and Epicureans wrangled for ages about the *summum bonum*, its constitution, and the mode of its attainment; and after all, it has been clearly shown by modern writers, that the controversy was a mere war of words,—that, so far as ideas on *bona fide* principles were concerned, both parties were agreed that it could only be that principle, or mode of action, which secured to the whole body of the people the largest amount of happiness; in short, that happiness and the *summum bonum* were convertible terms. But the Greeks, from their quick and lively temperament, were fond of disputation; and the *summum bonum* being received as an abstract term, that neither had, nor could have, other than an ideal existence, it was admirably adapted to eke out the argument—to set aside the possibility of a settlement of the controverted points; because each individual of the two opposing parties asserted his right (which no one had the power to deny), to lay hold of the ideal entity, and to deck it out with contingent properties and circumstances drawn from his own imagination.—Hence, every disputant had his own *summum bonum*, the offspring of his own creative fancy, which had nothing that was discernible in common with that of his neighbour, except the name; and hence the wordy war became interminable. The controversy never was, and there is good reason to believe never will be settled, unless the terms are more clearly defined and restricted within certain determinate limits.

It were needless to point to the mathematics, for the purpose of showing that controversy is shut out from that department of science, simply by the well-defined and restricted application of the terms. This is so well known that it need not be insisted on.

But with respect to terms embracing subjects of a mixed or general character, it is difficult to confine their application within limits that shall preclude the possibility of misconception, or, what is worse, misrepresentation; and, at the same time, to allow them sufficient latitude to comprehend the whole subject. It must, however, be allowed by every one who has given an ordinary share of attention to philosophical subjects, that in this department there is much room for improvement, and that, therefore, something may be gained by the attempt. If our endeavours be rewarded with only partial success, we shall consider that our labour has not been thrown away. And first, our attention should be directed to the introduction of a more orderly arrangement of those terms which form the basis of the physical science of modern times, from which the fundamental principles of our philosophy are derived.

Words are the types of things; and if the type could be made to represent the thing typified, completely denuded of all extraneous circumstances of all contingent and accidental properties, the great and fruitful sources of misconception would be almost entirely removed. The first step towards a right notion of proper terms rests upon, or is derived from, the following consideration:—Throughout the whole of nature, every condition, change, circumstance, or property, essential or accidental, of which we are competent to take cognizance, whether in morals or in physics, can only be recognised and treated of in a *relative sense*; that is, by comparison with the conditions, changes, &c., of surrounding objects. It thus appears that those terms only can be accepted as faithful types, in which the thing typified is presented to our mind in this *relative sense*, because in this sense only can we take a proper estimate of the attributes or properties with which it may be clothed. Relative terms are, therefore, proper terms. There are no absolute conditions or properties, therefore absolute terms are improper; they convey to the mind an idea which has no foundation in nature. In the following table we have eighteen varieties, or forms of expression, under which are comprehended *two* general ideas—those upon one side all spring from the same *root*,

* These lines are from a beautiful and philosophic Ode, by Junius Redivivus.—Vol. 23, page 391, Mechanics' Magazine.

and those upon the other, spring from a root that is diametrically opposed to the first. But although we find the same two ideas in a general sense throughout all these terms, we shall also find, if we examine some of them attentively, that they are very apt to mislead us in philosophical considerations. For instance, *weight;* although we very readily understand what is meant in the common business of life by this term, yet, however strange it may appear in a philosophical point of view, it has absolutely no meaning whatever. A pound weight of matter, is a pound weight; but it is only so in a *relative sense,* as it is referred to the earth's attraction. Let us suppose the earth and all surrounding matter to be removed, and it is no longer a pound weight; its weight is nothing. The word is established, it suits the purposes of common life, and is, therefore, sufficient so far as those purposes are concerned. But the terms weight, gravity, and attraction, have been so mingled and confounded, that by many they are used indiscriminately, even in philosophical disquisitions, without a due regard to the relative sense.

But the misconception arising from the indiscriminate use of the *absolute* term, *weight,* and the *relative* term, *attraction,* is but a small portion of the evil. There is still another and a higher view of this *relative* sense,—this leading star of phisophy,—this lens through which all objects in the physical world ought to be viewed; and the term weight will serve to illustrate this also:—A stone *falls* through the atmosphere *to* the earth's surface by its *weight*—vapour *rises* through the atmosphere *from* the earth's surface by its *lightness.*

Now for the explanation upon hydrostatic principles:—The stone falls through the atmosphere because it is *heavier* than air—the vapour rises through the atmosphere because it is *lighter* than air. Then, we find, by this hydrostatic explanation, such as it is, that a body falls because it is *heavier,* and rises because it is *lighter* than *another body.* Here the relative sense obtrudes itself upon our notice, whether we will or no. What is *lightness* considered absolutely?—Nothing. What is absolute *heaviness?*—Nothing. What is levity?—What is gravity?—Nothing. A cubic foot of water is *lighter* than a cubic foot of gold; but a cubic foot of steam is *lighter* than a cubic foot of water; and why is the steam *lighter* than the water?—Because it is *expanded.* The intervals between atom and atom have been increased by the introduction and admixture of the *imponderable* body, heat.

Now, I would ask the sage doctors of the gravitating school, why they call heat, light, &c., *imponderable bodies?*—Because their lame hypotheses will not furnish a better term. There are, however, two ends to their system, at one of which we find imponderable bodies, and absolute gravity at the other.

Weight, heaviness, and gravity, with their opposites, being in the foregoing view set aside, there remains the relative terms, attraction, contraction, and recomposition, for our acceptance as proper terms, as in the following table:—

Absolute or Improper Terms.

Levity of Matter.	Gravity of Matter.
Lightness of Matter.	Heaviness of Matter.
Weightlessness of Matter.	Weight of Matter.

Relative or Proper Terms.

Repulsion of Atoms.	Attraction of Atoms.
Expansion of Matter.	Contraction of Matter.
Decomposition of Matter.	Recomposition of Matter.

Mechanical Terms.

Pushing.	Pulling.
Shoving.	Drawing.
Thrusting.	Tugging.

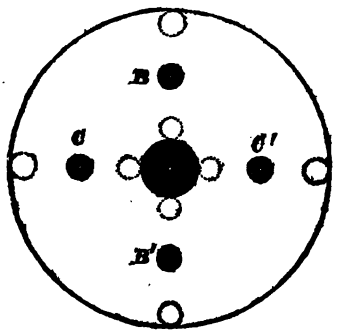
Let *a a,* fig. 1 (next page), represent two little balls upon the plane *b b,* and let them mutually attract each other. It is plain that motion will ensue, that the balls will move towards and meet at the point A, and under the force of attraction alone there they must remain at rest for ever.

Again, let the two balls mutually repel each other, and they will move from A to B B, and under the force of repulsion

alone they would remain for ever at rest.

Fig. 1.

2.



But let the repulsive and attractive forces act alternately and between the point A and the points B B, the two balls may continue in motion for ever.

This simple diagram illustrates and explains *all the known motions on the earth*, and, by analogy, may also serve to illustrate the motions of the whole material universe. The circumstances will not be changed, whether we conceive these two little balls to represent two atoms or two worlds. But we must bear one condition in mind, which the diagram does not represent, that from the angle of incidence of the two opposite forces, all bodies under their action must necessarily move from and to the centre, in circular or spiral paths, and not in right lines. Now a very little consideration will enable us to perceive that the motion of the balls from the central point A, or from each other, under the *repulsive* force, gives the idea of the *expansion* of matter in its simplest form, and also a fair illustration of the *decomposition* of matter. Therefore, these three terms represent the same idea of a *repelling, expanding*, or *decomposing* FORCE. The three terms may be accepted as synonymous, or, at least, as varied by very slight modifications. In the same way the *contraction* and *recomposition* of matter are found to coincide with *attraction* or the attractive force.

It is very plain that these attractions and repulsions do not furnish ideas corresponding with the common notions of heaviness or weight, nor their opposites, lightness or weightlessness, because we conceive of heaviness and lightness as *absolute* conditions, and therefore, when they are compared with a *relative* standard, we find them devoid of meaning; with respect to gravity, it is proper or improper according as it is given absolutely or relatively; if it is given and received as signifying attraction, it is a proper term; but we must recollect, that under the influence of an *attractive force only*, motion could not continue on the surface of the earth; with this one force only, there could be no motion *from* the surface. But there is motion both from or to the earth's surface; if, therefore, it is contended that motion towards the earth's centre proceeds from gravity, it must be admitted that motion from the centre or upward motion, as we would call it, proceed from levity; and what is levity? Nothing. I presume that no one will be found sturdy enough to contend that levity is the representative of a force.

But it may be said, that referring the action of gravity to an horizontal plain, is giving an unfair view of its mode of action. Let us, therefore, turn to diagram, fig. 2. Here we find repulsion, expansion, attraction, contraction, apply with equal propriety, as in the former case. A repulsive force exerted between A, B B′, and C C′, represents the expansion of matter; and an attractive force between the same bodies represents the contraction of matter. Here our ideas are clear, if we know which of the two forces is acting between two or more bodies, we can tell at once in what direction the motion should proceed; but if we consider the bodies B B′ and C C′ as being influenced by heaviness or lightness, considered absolutely, our perception becomes confused, and we are at a loss to say in what direction the motion of these ought to proceed. In the same way (diagram, fig. 1), if we suppose one ball to represent the agent and the other the patient, their attractions and repulsions will give a fair representation of the mechanical forces, drawing and pushing, and will shew that they are *relative*, and therefore proper terms.

But a repulsive force, it may be said, has not been admitted, and we require some proof of its existence. Take the following colloquial illustrations:—

A. Let the diagram, fig. 2, represent a thin hollow glass globe, and let it be filled with air or water or coals, or, indeed, with any substance, and apply a strong heat to the exterior surface, what will be the effect produced?

B. Why, the globe will burst and be shivered to atoms. There is nothing new or wonderful in this; it has been known for ages.

A. Oh no, there is nothing new in it. But *what force* was it that burst the globe; was it the force of gravity?

B. No, not gravity; the globe was burst by action of heat upon the matter contained within it.

A. "By the action of heat," that is a vague expression; it gives no intimation to the mind of the *modus operandi*. To say that it was burst by the *expansion* of the enclosed matter is better. The word and the idea, the type and prototype, have some resemblance to each other, when we apply the term expansion, the enclosed matter does expand.

B. Not unless you apply the power of heat.

A. True; but man cannot create power. He may concentrate force to a point, for the purpose of obtaining an intense power, or he may diminish its intensity by dispersing it—in a word, he may direct; but he can neither create nor destroy force, therefore the expansive force is a natural not an artificial force—there are no artificial forces.

B. Well, suppose we allow it to be an expansive force, and a natural force, what then? It would be ridiculous to set up the force that will burst a little glass globe against the power of universal gravitation.

A. Not more ridiculous than setting up the fall of an apple against the equally universal force of expansion exerted by the sun and planets.

B. "Equally universal force of expansion."—Well, I allow this force to exert upon a small scale, but I cannot see any thing to give it a title to be considered a universal force like gravitation.

A. That is because you have been taught to look at force, acting at the surface of the earth only—that universal space is a vacuum, and therefore devoid of force; if you consider universal space a plenum, filled with expanded air, which is more agreeable to natural principles, all your reasonings become void—your system falls to pieces.

B. True, but you must prove that it is a plenum, the *onus probandi* falls upon you if you assert that proposition.

A. Yes; but you must not shift the *onus* from the proper place; you have not yet proved that it is a vacuum, and I think that the glass globe will show that there are two forces, that they balance each other, and that in every case motion ensues if the equilibrium be disturbed, and not otherwise. We will return to the glass globe: but in mean time, by what force is the immense quantity of vapour, which rises from the earth's surface yearly, made to recede from the centre of the earth, in opposition to the law of gravity. Professor Leslie estimates the quantity of moisture exhaled in a year over the surface of the earth as sufficient to form a shell or covering of water five feet deep.* Now it certainly requires a force to move this immense body of matter—it is plain that gravity is not the prime mover.

B. Oh, that is the same as the glass globe, it is the heat of the sun that causes the water to rise in the form of vapour.

A. That is, it *expands* the water.

B. Yes, certainly, the water is expanded; it would not rise otherwise.

A. Then compare this with the expansion of the water in the little globe, is not the analogy perfect and complete; if the earth were surrounded with a film of glass, the heat, or expansive force of the sun would break the glass.

B. The analogy is certainly very close.

A. One thing appears pretty clearly, whether this force of expansion be admitted to be universal or partial, its line of action is diametrically opposed to that of gravity; if the two forces balance each other, no motion will ensue; if the expansive force be the stronger, it will repel or push from the centre—as in the atmospheric steam-engine, when the expansive force of the steam is the stronger, it repels or pushes up the piston against

* *Mechanics' Almanac*, 1837, p. 41.

the force of gravity; and when the expansive force, is the weaker, gravity, through the medium of the atmosphere, brings the piston down again; in both cases it is by the equilibrium being destroyed motion is obtained, and the proportion of the power is in the ratio of the difference between the two forces.

B. This is all true. But nature is not a steam-engine.

A. No, but it is moved by natural forces. In the system of nature, motion is the result of *two forces*, acting alternately, as in the steam-engine; motion cannot be continued with *one force*. But let us reverse the circumstances; let the glass globe be filled with oxygen and hydrogen gases in the proper proportions —let the electric spark be passed through the gases, and they will be contracted into the form of water. Let this water occupy the centre of the globe, and be represented by A. Then, between the *exterior* surface of A, and the *interior* surface of the glass, there will be a vacuum, and the exterior surface of the glass will be acted upon by a force that will shiver it to pieces, as in the former case, when the force acted upon the interior: what force is this?

B. Oh, the force of gravity to a certainty, there can be no mistake in this case.

A. But the action of this force was equal on every side of the globe; on that presented to the earth as well as on the remote side.

B. That is agreeable to the principles of hydrostatic pressure—fluids press equally on all sides.

A. Yes, but that hydrostatic pressure was present, and exerting the same pressure before the contraction of the gases took place, as afterwards, but was balanced by the *expansive force* of the enclosed gases, until the equilibrium was destroyed by the *contractive force* within; and as the sheet of glass was interposed in the line of this force it is pressed towards the centre, following the same line that the gases followed in their contraction by the electric spark. Can you perceive any connexion between the contraction of the gases considered as an effect, and the electric spark considered as the operating cause.

B. The whole subject of causation is involved in mystery. We see effects only, we cannot in any case pretend to connect those effects with their immediate causes; and this case is like others—we see the effect, but we see nothing of the *modus*, or manner of connexion.

A. The contraction of a body, an iron bar for instance, and the attraction of the earth on opposite sides, taken in a line passing through the centre bears a close analogy, and may be illustrated by referring to the diagram, fig. 2. Let C C′ be the extremities of the line; then, by the *attractive* force of the central body A, or by the *contractive* force of iron in passing from a heated to a cold state, the line will be shortened.

B. I see no analogy whatever here, the bodies CC′ do not require to be either hot or cold to cause them to be attracted by the earth.

A. The analogy is not to be referred to heating or cooling in the common acceptation, but to *expansion* or *contraction*. Let the two bodies *d d* represent two globes of expanded matter, two balloons for example, they will recede from the centre, and the line will be lengthened as the bars of iron are lengthened.

B. Oh, the rising of a balloon can be explained by the action of gravity upon fluids, withrut introducing an expansive force.

A. Oh yes, no doubt; but if the motion with which the balloon was filled had not been expanded in the first instance, the balloon would not have ascended, the ascending *power* began with the expansive process. In short, I admit that there is an *attractive* or *contractive force*; and as I am not disposed to differ about terms, so long as they are proper terms, I am willing to accept the term gravity in that sense. But I contend, that there is a *repulsive* or *expansive force* also, that the two forces are equal in power and extent, and that if you insist upon retaining the term gravity, you must likewise admit the term levity, into your vocabulary. There is as much meaning in this word as in the other, and your system is not complete without it. I could fill a volume with mere notices of the force of expansion; it has thrown down buildings and bridges, has raised mountains and islands, and even whole continents. It is necessary to the motion of the steam-engine, the human heat, and that of all animal heats; the winds, hurricanes, and the

rivers, name the origin of their motion in this force. In short, there is no motion without it; a very considerable portion of the earth is annually expanded by its action; and if we examine the earth's structure, we may perceive evidence that cannot be doubted, that the whole earth has passed from an expanded to a more contracted state, and is still contracting. When it has reached the ultimate point, it will be again expanded: the works of nature never come to a stand.

The *expansive force* would be immediately recognised and admitted to an equal participation in all the great operations of nature, were it not that, from the limited nature of our perceptions, we are unable to trace its working downwards to the last step in the process. The action and re-action of aggregates are visible; but those of ultimate atoms elude our senses, aided by all the refinements of art. Although we ourselves, and every thing by which we are surrounded, must necessarily be composed of exceedingly minute particles or ultimate atoms, we cannot say with any pretensions to certainty how many millions of these may be required to form an aggregate that shall be barely perceptible to the eye, aided by the most powerful microscope; therefore, all our speculations and reasonings about atoms are in some degree metaphysical—because, at that point of the inquiry where the faculty of *perception* fails us, the faculty of *conception* is called into action. With this *mental* faculty we prosecute the inquiry; and if reason and conception are allowed to proceed hand in hand, we may venture into the metaphysical region with some degree of confidence. We have only to consider, that the point upon which we stand separates the visible world from the invisible—that the same orders of power and motion descend to the lowest or most minute particle of matter. If we conceive in this manner, our conceptions are rational, because they accord with known things: but if we introduce new powers, if we forget the analogies that must subsist throughout the whole range of material existence—we begin to conceive without reason and comparison, until at last we find ourselves in a world of abstraction, in a metaphysical labyrinth, without a thread to lead us back into the world of palpable realities.

But, after all, with respect to ultimate causes it is little, indeed, that we can ever hope to know. The age of man, or of the whole human race, is but a point in time; the solar system is but a point in space; the actions and re-actions of almost infinitely minute atoms, and of infinitely extended aggregates, equally elude our powers of research. It must be confessed, and it may as well be confessed at once, that the human mind is not equal to the task which it constantly imposes upon itself, of investigating physical relations and the connexions of causes and effects. Before we can attempt to draw conclusions, involving in their general results a presumed knowledge of the hidden workings of primary forces, we must be endowed with faculties and perceptions of that extended or infinite character that shall enable us to discern the connexion of the whole chain of causation, from the affinities of ultimate and invisible atoms, upwards, to the actions and re-actions of infinitely extended aggregates. Nor would our system then be complete: we must fill up the circle of motion, we must follow the line of causation round or back to the point at which our reasoning commenced. The mind shrinks and falls back at the bare contemplation of a task which requires her to trace and unfold the workings of cause and effect throughout a circle embracing the whole material creation; and yet thus much is required before it can be pronounced that any system of philosophy is complete.

I am fully aware that in making the foregoing admission, with respect to the incompetency of our mental faculties to grapple with and unfold the connexion of physical causes and effects, that I have furnished an argument that may be turned to some account by those who may have been predisposed to offer an opinion in opposition to the general views advanced in the electrical theory. But let those from whose tongues the word *demonstration* falls so often and so heedlessly, beware how they handle that argument, for they will find that it cuts like a two-edged sword, to the right as well as to the left; and that whilst they unthinkingly imagine that the system of their adversary only, will suffer in the

conflict, they will find its strokes fall with equal energy upon their own.

Although we cannot hope to know all things, we must not, on that account, stop short in our inquiry, and forego the little that is within our reach—one of the most important points in natural philosophy is to determine from what sources mechanical motion may be derived. Viewed in this light I am persuaded that the publication of the electrical theory in the *Mechanics' Magazine*, has not been without a beneficial influence. I have endeavoured to show, and I still maintain, that there are two *forces* necessarily engaged in the production of all continuous motion—the effect proceeding from one has been named *expansion*, and that from the other *contraction*. If those who have hitherto strained their ingenuity to produce a perpetual motion by mechanical arrangements, have been enabled to perceive that *all the motions in the earth* have their origin in these two forces, they will see the futility of seeking motion from any other source than from those forces which exist in nature, and their attention being drawn from "vain pursuits," they will cultivate more assiduously an intimacy with the true sources of motion, with a view to obtain the largest amount of power from their operation.

The principles upon which the electrical theory rests may be expressed in the two following propositions:

All motion may be traced to the expansion and contraction of matter, considered as effects.

The maximum effect on either side is produced by electrical agency, considered as a cause or causes: therefore that which produces the greatest effect is the greatest power.

In support of these views, and also as furnishing some useful hints, I beg to submit a suggestion of a writer in the *Chemist*.

"The great principle," he observes, "is the application of voltaic electricity to the purposes of producing mechanic power. There is an instrument which produces, by the continued production of electricity, a perpetual though not an equable motion. This principle has only been hitherto applied to make mere toys; but the voltaic battery, the most powerful instrument with which science has yet armed the hand of man, presents continual renewal of the electric current. Why cannot we apply this instrument to produce a perpetual mechanic power? In *Brown's* pneumatic engine, the source of the power consists in burning hydrogen in atmospheric air. Brown found it very difficult to get rid of the nitrogen; but if we decompose water by means of galvanic electricity, we can produce abundance of oxygen and hydrogen in these exact proportions in which they combine; and when flame or the electric spark is applied, they will condense into each other, and produce the most perfect vacuum which the art of man can form. A new power, hitherto never thought of, never put to any use, may be generated by *decomposing* water by means of galvanic electricity, and *recomposing* the resulting gases by means of the electric spark.

"By this means, we generate a power (the two gases) in the first place equal to an additional atmosphere, and when we have thus generated this atmosphere, we may form a perfect vacuum by inflaming and condensing the gases, for the volume of the gases is diminished nearly two thousand times. Thus, by a continued production of electricity, which is generated by a voltaic battery, we may go on for ever *decomposing* and *recomposing* to the end of the world, an enormous power with apparently inadequate means. Another thing also which requires to be observed is, that the copper and zinc, and the acid employed, would not be annihilated, and might be recovered; consequently, the expense of supplying these articles, will be little more than the expense necessary to recover them after being used. Thus, the power actually employed is only that immaterial agent which is made manifest on the decomposition and recomposition, and which, as it is measureless, is inexhaustible."

The power of the steam-engine is derived from the *expansive force* of steam, but our knowledge does not enable us to pronounce with certainty, that this is the best medium through which the expansive force can be transmitted. There may be, and very probably there are, *superior media*; and whilst a doubt remains on that point, there remains something valuable to be discovered.

T. S. MACKINTOSH.

London, Dec. 12, 1836.

MR. MACKINTOSH'S ELECTRICAL THEORY OF THE UNIVERSE.

'SIR,—Mr. Mackintosh, in his concluding Lecture on the Electrical Theory of the Universe, still maintains that our unfortunate earth is gradually approaching the sun; from which he concludes, that the length of the year is becoming shorter in every successive revolution of the earth round the sun. In support of this part of his theory Mr. Mackintosh informs us that the Chinese, Judeans, Chaldeans, Egyptians, Greeks, and Romans, however they differed in other points, all agreed in giving the year a greater value than that which is known to be the true value at the present day." Mr. Mackintosh, however, only tells us what the ancient Egyptians had determined the length of the solar year to be, namely, 365¼ days, and this certainly was a very near approximation, being only eleven minutes twelve seconds and four-tenths of a second longer than it is at the present time. Mr. Mackintosh might also have stated the length of the solar year, as determined by the observations of the Chaldeans, who were certainly superior to the Egyptians in astronomical observations. But Mr. Mackintosh no doubt found this would not have answered his purpose.

The ancient Chaldeans, before the conquest of Babylon, determined the length of the solar year to be 365 days five hours forty-nine minutes fifty seconds, being only seven-tenths of a minute longer than it is at present. When the crude state of the astronomical instruments used by the ancients is taken into account, compared with their present perfect state, the Chaldean determination of the length of the solar year is by far the most accurate astronomical achievement recorded of ancient observations. But although the Egyptian priests had settled the length of the year at 365¼ days, and allowed the odd six hours to run on, as stated by Mr. Mackintosh, still this is no proof but what they might have been aware that the solar year was somewhat shorter; and, in support of this fact, Albategnius, the most celebrated of the Arabian Astronomers, informs us that both the Chaldeans and Egyptians had determined the length of the sidereal year to be 365 days six hours and eleven minutes, being somewhat less than two minutes more than it is at the present day. The naming of the sidereal year induces Montucla to suppose that at this early period the Chaldeans and Egyptians must have been aware of the precession of the equinoxes. But Ptolemy informs us that this great discovery was first made by Hipparchus, although the Julian kalender fixed the year at 365¼ days, still Julius Cæsar knew well that the true length of the solar year was somewhat less, for we are informed that he took the help of Sosigenes, an able astronomer of the Alexandrian school, a man perfectly acquainted with all the discoveries of Hipparchus and others of that celebrated academy. It is a curious fact here deserving of notice, that the Mexicans, when first discovered by the Spaniards, employed a cycle which supposed that the year contained 365¼ days, for at the end of fifty-two years they add thirteen days, which is equivalent to adding one every fourth year.

Mr. Mackintosh then goes on to endeavour to prove that the earth is nearer to the sun than it was in ancient times: he states that the apparent diameter of the sun, when viewed from the earth, is greater at present than it was some thousand years ago. Had he succeeded in proving this fact, he certainly would have established the truth of this part of his theory. (Supposing the real diameter of the sun to have always been the same, which is giving him more credit than he is fairly entitled to, as he supposes that all the planets originally formed a part of the body of the sun.) But let us see how he is borne out by recorded observations. In the first place the sun's greatest apparent diameter for this present year, 1836, is 32′ 34·6″ (Dec. 31), and the least 31′ 30·2″ (July 2), the arithmetical mean between these two is 32′ 2·4″; again, I have taken an arithmetical mean between six recorded diameters from the time of Hipparchus to that of Tycho Brahe, the mean of them all is 32′ 20″. Tycho's I have rejected, because he makes the maximum and minimum diameters much less than any recorded before or after his own time, (he states the mean diameter to be only 31′ 00″); again, by taking a dozen of other recorded mean diameters, observed since the discovery of the telescope to the present time, I find the mean of them all to be 32′ 3·1″, from which it appears, if we could place implicit faith in these ancient

observations of the sun's apparent diameter, then we must allow that the earth, instead of continually approaching nearer the sun, is, in fact, receding from it. But these ancient observations are faulty on two accounts, even granting that their instruments had been perfect. 1st. They had no accurate knowledge of the sun's parallax. 2nd. Refraction was altogether unknown to them. But although allowances were made for parallax and refraction, this would not have the effect of showing that the sun's apparent diameter in ancient times was less than it is at present. In fact, when the earth is at her mean distance from the sun, that is when the centre of the earth passes the extremities of the axis minor of her orbit, in every semi-revolution the sun's semi-diameter is getting less and less, and this will continue to be the case until the excentricity of the earth's orbit becomes a minimum; the consequence of which is, that the real circumference of the earth's path, instead of contracting is in reality expanding, and all this is fully established by accurate observations.

Mr. Mackintosh, notwithstanding his pretended veneration for Newton, still continues to sneer at some of his principles, gravitation among the rest. He seems to consider most of them as mere metaphysical or fanciful hypotheses, which have no existence in reality. Nothing can be more unfair than this. Newton was too profound a logician ever to be led astray by metaphysical jargon no supposition or conjecture he ever attached any value to; he felt the force and importance of that maxim so warmly inculcated by Bacon, "That nothing is to be received as proved, in the study of nature, that is not *logically deduced from an observed fact;* that accurate observation of phenomena must precede all theory; and that the only admissible theory is a proof that the phenomenon under consideration is included in some general fact or law in nature." Newton, in his principles of Natural Philosophy, uses the word gravitation as an expression, not of a *quality*, but of a *fact*—not of a *cause*, but of an *event*—when he shows, "that the primary planets are retained in their orbits round the sun, and the satellites in their path round their respective primaries, by a force tending toward the central body." Here it must be noticed, that this expression ascertains nothing but the direction of the force; it gives no hint as to its manner of acting—"it may be the attraction of the central body"—"it may be a tendency inherent in the planet"—"it may be the influence of some ministering spirit;" *but whatever it is, this is the direction of its effect.*

Mr. Mackintosh perhaps has read the poem of "The Loves of the Triangles;" if he cannot reconcile his mind to the term universal attraction, he may change it into that of the universal loves of the planets.

I have read Mr. Mackintosh's last letter (No. 693); it is a strange production. I have not made up my mind whether I shall answer it or not. If I should, I trust Mr. Mackintosh will not take it amiss if I should season my lucubrations with the same ingredients as he has thought proper to do in his last.

KINCLAVEN.

CHALKLIN AND BONHAM'S PATENT VICES.

Sir,—"A Blacksmith" who kindly communicated to your Magazine, a few weeks since (No. 691), a description of Messrs. Chalklin and Bonham's patent vice, seems to have his doubts as to the ball and socket "answering its end under a great degree of pressure."

I respectfully beg to inform him, and any other person who may entertain similar doubts, that the patentees have had vices of their improved construction in active and hard work for many months past; and that there is not the slightest symptom or chance of a failure in those parts. Any person wishing to convince himself on this point, may do so by calling at No. 408½, Oxford-street, where he may see them in use.

Your correspondent must have been misinformed, as the dock-yard at Woolwich has not, *at present*, been supplied with any of this improved kind.

I believe the parallel vice, mentioned in the same communication, is some five or six years old; therefore, its practical advantages and utility must be by this time well known and appreciated by the public, *if it is possessed of any.*

By giving the above a place in your very useful publication, you will greatly oblige the patentees, and yours, &c.

JAMES PILBROW.

Barnet, Dec. 10, 1836.

THE FIRE-INSURANCE SYSTEM.

Sir,—I have read Mr. Baddeley's communication in answer to the remarks I made on the conduct of the Fire-Companies, and though I am ready to defer to his knowledge and experience in matters connected with that on which we are at issue, I take leave to subjoin a few lines, which you will be pleased to give a place in your Magazine, if you consider them pertinent to the question.

The ostensible motive to insure against fire, indeed the compact between the Insurance-Companies and the public, is simply, that any loss occasioned by fire shall be made good by the Company, excepting, of course, in such cases as are proved to be fraudulent. It is, however, the interest of both parties that the loss should be as light as possible; for, in the case of the public, the destruction of property is attended with many circumstances which a remuneration to the amount of loss sustained does not compensate; thus in a manufactory positive injury is sustained by loss of time, the destruction of machinery, tools, &c.—and this holds good, *mutatis mutandis*, in every instance. Here, then, *prevention* is more than equivalent to the remedy proposed. All parties have a common interest in the preservation of property; and it is unreasonable, all circumstances considered (I admit it is not so "specified in the bond"), that the insurers expect the utmost vigilance, and the employment of the most efficient means, in arresting the progress of fires, when such an interest is at stake so considerable as to include a third of the entire property of the metropolis.

There is no analogy in the case of the Insurance-Companies and that of a private individual. By taking upon themselves the administration of a fire-police, the Companies *tacitly* guarantee protection to the insurers. For against accidents originating directly on their own premises or dwellings only. And the insurer understands from this circumstance that this is only a measure of self-defence on the part of the Company; and as every one is liable to such calamities, calculates on a protection and prevention which, as has been already observed, both parties are equally interested in securing.

By the strict letter of the agreement, the Companies are not bound to provide fire-engines or organise a fire-police for the protection of property. It is sufficient for our purpose, however, that they have done so, since by so doing a responsibility attaches to them. It is idle to argue that they are at liberty to be as careless as they please with their own property, as if the consideration was something altogether ordinary, and they were the only persons interested. In equity, their relation to the public is of the nature of a trust. Suppose the Gas-Companies thought fit to discontinue suddenly the supply of gas, and argue, "We are not bound to continue to light your streets, houses, and shops. We think it expedient to discontinue this manufacture; and you have no right to complain, since there is no violation of the compact between us, and you have had your money's worth." The proprietors of water-works might also, by a parity of reasoning, discontinue the supply of that indispensable article, at pleasure; they are not bound to consult the consequences of their act and deed; they also may do as they like with their own; there is no guarantee on *their* part, nor does any really exist between the community and public bodies in any instance. But is it to be asserted from such premises that they are upon the bare supply, and acting to the strict letter of the agreement—in other respects, free to act as they please? Nay, so jealous should the constituted authorities be of the general safety, that even individuals must be controlled and subjected to strict laws in their relation to the entire body. Thus we find man is *not* at liberty to do as he pleases in the erection of a dwelling. The addition of a party-wall is imperative, as the safety of the community is supposed to be secured thereby. The propriety of such an interference cannot be questioned, though it would seem, from the way in which Mr. Baddeley argues the case of the fire-offices, that provided the materials were duly paid for, and the labourers' hire apportioned, and no one prejudiced, the good man may build according to his judgment, or his want of judgment. Now, though this wholesome enactment emanates from the Legislature, the *public* are represented by that body, and the *act and deed is their's;* but, forsooth, they are to have no voice in a matter of

far greater import, because it relates to a *Company*, or body of men, who would fain shelter themselves under this mysterious cognomen from all comment and censure, be it ever so justly merited. It is incompatible with existing circumstances to realise first principles, and act on the abstract law of *meum* and *tuum*; mutual concessions, nay, occasionally, sacrifices, are imperative to the security of the whole.

Mr. Baddeley comments freely on the "reprehensible apathy" displayed by the public in neglecting to provide the means of protection against fire, and further informs us, that they seem rather to court than shun the evil. Whether this be so or not, I am unable to say. Mr. Baddeley has paid much attention to the subject, and doubtless makes this appalling statement of a fact upon sufficient evidence. In this instance I readily defer to his knowledge and opportunities for observing; but I claim a right, as well as he, to comment and pass a censure where I think it merited. If the neglect and supineness of the community is reprehensible, that of the Companies is still more so, as *they* incur a risk so enormous as to include not less, on Mr. Baddeley's own showing, than a third of the gross property of the metropolis, and are further, as they are, utterly unable to realise any thing like that amount, should they be called on to do so. Here, then, a trust reposes in the Companies, in the due and just administration of which all are interested; and if the public may be censured when censure is due, Public Companies are surely not to be exempt under similar circumstances. For my part, I can discover no just reason for the distinction.

In the course of this discussion we have lost sight of the subject which immediately gave rise to it; and though I have duly considered Mr. Baddeley's objections, I must take leave to revert to the question as it was originally mooted, and ask why Mr. Braithwaite's steam fire-engine is not employed for the purpose of extinguishing fires? Mr. Baddeley's strictures on the apathy of the public may justly be applied to the Insurance-Companies; and I assure him that I am as well persuaded as he is, that "much good will ultimately of necessity arise to all parties, by a more correct understanding of the *true* relations existing between the public and the Insurance Companies."

I am, Sir, yours respectfully,
P. R.

Dec. 9, 1826.

CASTING AND GRINDING SPECULA.

Sir,—In No. 678 of the *Mechanics' Magazine*, dated 6th August last, which has only just come into my hands, I find a letter signed C. G. on the subject of casting and grinding specula, in which the writer refers to a long-expected communication from Mr. Ettrick, and states that he has for some years laboured unsuccessfully in endeavouring to discover a method of casting specula free from porosity and holes in the surface. I have for several years devoted a portion of my leisure time to the construction of reflecting telescopes with, I venture to assert, a large measure of success; and if you think the subject will be interesting to your readers, I shall be happy to communicate in a few letters, as my leisure may permit, such results of the experience I have acquired in the art, as it may occur to me to detail. I have not found in common with your correspondent, that greater difficulties attend the casting than the figuring and polishing of mirrors; indeed, I attained some years ago, by the process I am about to describe, such a degree of perfection in casting, as left me little to desire in that branch of the art, and therefore my late efforts have been chiefly directed to such improvements of the figure and polish of reflectors, as might make them rival the best refractors in the definition of the fixed stars.

The metal of which specula are made is a composition of copper, grain or bar tin, and arsenic, in the following proportions:—Copper, 32; tin, from 15 to 16; arsenic, 1½ by weight. The qualities of this composition are extreme hardness, brittleness, whiteness, and a great susceptibility of polish, which seem all to depend as to their maxima upon the *accurate* proportions between the copper and tin. It would appear that different qualities of copper require different quantities of tin to produce the maximum of perfection, and that this causes the proportion of tin to vary between 15 and 16 to 32 of copper. If the copper be clean and good, one may

be sure of a good metal by making the quantity of tin 15½, and adding the due proportion of arsenic, although after a little experience it will be found better to try the metal itself in the process of mixing. Old copper bolts of ships are very good and convenient for melting. The proper quantity of copper must first be put into the crucible, and rendered perfectly fluid. The proportion of tin should then be melted in a separate crucible, the crucible containing the copper withdrawn from the furnace, the tin poured into it and well stirred with a clean iron rod or dry stick of wood. As the mixture is fusible at a much lower heat than the copper alone, it will be quite hot enough after the stirring and withdrawing from the furnace to pour into the moulds, and I have made very good metals by this process. But I think it much better for the compactness of the composition and freedom from pores to introduce a second melting before the casting, and pour this first mixture immediately after it is made and well stirred over a birch-broom into a large tub of water, which instantly cools and granulates the metal; thus preventing, it is said, the calcination of any part of the tin by its remaining any length of time at the great heat imparted to it by the copper. Somewhat less than the due proportion of tin should, in the first instance, be added, not more than in the proportion of 15 to 32; and in the second melting, when the composition is ready for pouring, a small quantity should be taken out in a ladle and instantly cooled in water. It will most likely crumble almost to pieces, or, at any rate, will easily break with the fingers. If the fracture is extremely white and brilliant, like quicksilver, the arsenic may be now added, wrapped up in a piece of paper, and well stirred in, until the fumes have disappeared. It is, however, most likely that the composition will bear the addition of a little tin, and it will be convenient to have small portions weighed ready, such as would raise the proportion of tin from 15 by tenths up to 16, if necessary. Very small portions will make an obvious difference in the fracture, and it may perhaps be well to add one dose beyond what may be considered the *ne plus ultra* of brilliancy, to insure a somewhat firmer texture. A very little experience will enable the operator to ascertain pretty accurately by the fracture the proper quantity of tin, but the copper should never be in excess, which would render the metal liable to tarnish. Too much tin renders the fracture dull and grainy, and the metal very tough and difficult to work. I do not consider the addition of arsenic absolutely essential; I have made good metals without it, but was generally accustomed to its use, and so far as my experience went, its effect seemed to be to whiten the metal, and indeed to be somewhat similar to that of an additional small portion of tin. The furnace I used was built upon the plan of that described in Henry's "Chemistry," 11th edition, vol. i., p. 680, and there stated to be the invention of Mr. Knight, of Foster-lane. Its size, however, of nine inches square inside, was rather too small for melting with quickness the quantity of metal necessary for a nine-inch speculum, though I have cast a larger size out of it. Its construction is convenient for allowing the fumes of the arsenic to escape, which otherwise might be pernicious.

To describe the process of modelling, the metal in the sand would, I fear, extend this letter to an unreasonable length, I shall therefore reserve that subject for my next communication, and in the mean time,

Remain, Sir,
Your most obedient servant,
WM. LASSELL, Jun.

18, Norton-street, Liverpool,
Dec. 6, 1836.

MR. HOWARD AND MR. SYMINGTON.

Sir,—In his last communication, Mr. Howard says I have descended almost to personal scurrility against him. I am not aware of having done so; and suspect Mr. Howard is himself the party against whom such an accusation might with justice be brought. And to convince him that my suspicion is justified, let me remind him he described as "twaddle" my thanking him for a piece of information, which he had given me through the pages of your Magazine, concerning his share in depriving me of the *Album*.

In reference to the completeness of Mr. Howard's plans, as exemplified in the *Vesta*, I must take the liberty of saying that it does seem rather strange

to me, if they be so very complete, that she should be so often withdrawn from public view, for the purpose of having perfection perfected. While Mr. Howard chooses to amuse himself without interfering with my patent rights, he need fear no interruption from me; but if he interfere with them, he will find me just as ready to defend them in any other quarter as I have been in your Journal.

I remain, Sir,
Your most obedient servant,
WILLIAM SYMINGTON.

1, King William-street, Dec. 8, 1836.

ASBESTOS GAUZE SAFETY-LAMP.

Sir,—The safety-lamp of Davy, notwithstanding its oft demonstrated insecurity, being still very extensively employed in the mining districts, it follows, that any improvement in its construction must necessarily be attended with considerable public benefit: and I therefore beg, through the medium of your Magazine, to offer the following suggestion regarding it. I propose, then, that the flame of the lamp be surrounded with a very fine gauze of asbestos, instead of the wire one with which it is, at present, invested. The advantage arising from this modification will be, that owing to the extreme slowness of asbestos in conducting or receiving heat, the gauze proposed could never be heated beyond a very trifling temperature; and that, consequently, the dreadful explosions, to which the lamp in its present form is so frequently giving rise, would thus be, in a great measure, prevented.

Humbly hoping that the above hint may prove valuable to that useful body of men whom it more particularly concerns,

I have the honour to be, Sir,
Your most obedient servant,
W. H. O.

St. George's East, Dec. 9, 1836.

REPORT ON MR. PRUTZMAN'S LEVER LOCK AND KEY.

(The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania for the promotion of the Mechanic Arts, to whom was referred for examination the Lever Lock and Key, invented by Mr. Prutzman, of Philadelphia, Report:)—

That they have examined the lock and key and find it to be a specimen of both *ingenuity and workmanship.*

The main feature in the lock is the manner of securing the bolt, so as to prevent its being operated on by means of a *pick*, and to prevent a key being fitted to it unless in detached parts. The lock is arranged with tumblers working vertically, and horizontally, so as to secure the bolt in its position, when locked or unlocked. The tumblers are operated on by means of a lever inserted in the bit of the key, and working on a centre. This lever is put in motion by a plate so arranged in the lock, as to pass into one of the wards of the key, and press the lever towards the barrel or stem. One end of this lever acts on a projection raised on one of the tumblers, causing it to descend, whilst a portion of the key acts on a parallel tumbler, causing it to ascend, the opposite end of the lever acts on a horizontal tumbler, and thereby relieves the bolt. When the bolt is shut the tumblers resume their former position, and secure it in its place. A lever is placed between the two parallel tumblers and working on a centre, the bolt is secured at one end and moved by means of a key at the other, causing the bolt to move in an opposite direction to that of the key.

The general arrangement of the lock is simple and good, and we may add the best that is within the knowledge of the Committee. From the common key an impression may be taken so as to form a duplicate; but from the present arrangement of a key, with a lever inserted, it will not be practicable, owing to the great accuracy required in the formation of the lever.

Mr. Prutzman deserves a great deal of credit for his *ingenuity*. The Committee understand that several of the locks are at present in use, one in the Counting-house of the United States' Bank, and others in the City of Baltimore.

W. HAMILTON, Actuary.

May 12, 1836.

PROPORTION OF DRAINAGE TO FALL OF RAIN.

In civil engineering, a knowledge of the relative proportion which the drainage bears to the actual fall of rain, is sometimes of the utmost importance. The following observations (from the *Franklin Journal*) were made in America, and may serve as a basis for a similar set of tables adapted to the climate of England:—

"The following deductions are made from two interesting tables, containing the fall of rain and the amount of drainage in Eatonbrook and Mudison-brook valleys, in the State of New York. They are taken from a report of John B. Jervis, Esq., chief engineer of the Cherrango canal, to the canal commissioners of the State of New York.

"From table, No. 1, it appears that the average drainage from June to December, 1835, inclusive (seven months) was 0·392 of the falling water, or nearly $\frac{4}{10}$; and the average from June to October, inclusive (five months), was 0·319, or nearly $\frac{1}{3}$ of the fall. August is the minimum month, and shows a drainage of 0·192, or nearly $\frac{1}{5}$ of the fall. July is the maximum month (except December, which drained the snow of November), and a drainage of 5·414, or over $\frac{1}{2}$ of the fall.

"From table, No. 2, it appears that the average drainage for the year 1835, including the snow on the ground on the 1st of January, was 0·449, or nearly half the falling water; January to May, inclusive (five months), 0·662, or say $\frac{2}{3}$ of the fall; June to October, inclusive (five months), 0·246, or $\frac{1}{4}$ of the fall. It will be observed that the quantity drained from June to October, inclusive, was very uniform, although the falling water was very different, which causes a great range in the ratios for the several months. This was produced by the mountains acting as reservoirs, causing the highest ratio to appear in the month of least fall, and the lowest ratio to appear in the month of the greatest fall of water. From which it is obvious, of June to October (five months), is required to give a proper view of the drainage during the season of the greatest evaporation."

The experienced civil engineer may, by that superior tact which is obtained by extensive practice, be enabled in some degree to dispense with such a guide; but to the younger members of the profession it would be of essential service, and even the veteran tactician might find it useful as a reference occasionally.

CRITICAL RETROSPECT — MACKINTOSHIANA—KINCLAVIANA.

Sir,—I have from time to time admired the ingenuity with which Mr. Mackintosh has developed and defended his new theory; but I must confess, that two matters have lately appeared in your Magazine which have materially tended to undermine my opinion of the depth and soundness of his views.

The first is his denial of the moon's rotation on her axis; in support of which he adduces the example of a ball of lead at the extremity of one of the arms of a fly-wheel; and he says, that if the moon revolve upon her axis, so also may the ball of lead be said to do: most certainly it may, and so it does, and so do all the particles of the said wheel each on its own imaginary axis.

To prove this, *I* also may be allowed to cite a few familiar examples; let Mr. Mackintosh pay a visit to Bartholomew-fair, take a jaunt in one of those child-delighting roundabouts or vertical merry-go-rounds; so long as the chair in which he may be seated maintains its parallelism, *or has no rotation on its axis*, so long will the motion be quite agreeable; but let the chair bottom be made fast to the arms of the machine, and my word on't, Mr. Mackintosh will experience a practical illustration of a rotation on his own internal axis.

If this suffice not, let Mr. Mackintosh take a bottle of crusted port; and, holding it by the neck, let him endeavour to make it describe an orbit round a candle, at the same time taking care to keep the crusted side always towards the flame; if he do not speedily discover the want of a universal joint at his shoulder to admit of the rotation of the bottle on its axis, I am much mistaken.

Lastly, let Mr. Mackintosh take a small globe, and having tied a string round its equator, let him affix a piece of yarn to one of its poles; let him then swing round the globe by means of the string, and he will soon find a thread of fairly spun yarn formed at the pole; could this take place *unless* the globe revolved upon its axis?

The other stumbling-block in the way of my high opinion of Mr. Mackintosh's reasoning powers, is the plan proposed by him for perpetual motion at page 149, and which, be it remembered, he only distrusted, when he distrusted the eternity of the universe itself! Now, Mr. Editor, I honestly aver, that of all the many gropings after the great *ignis fatuus* with which your publication has teemed since its commencement, this attempt of Mr. Mackintosh's appears to me the most absurd, the most unmechanical, and the least plausible.

Mr. Mackintosh thought, that if a squirrel could turn round a tread-wheel, so also ought his bullet, in like manner attracted by its magnet; but in the first place, it is necessary to make the two cases parallel. In order to do so, a cord must be noosed round the neck of the squirrel to represent the magnet, and the other end of the said cord being made

fast to the ceiling, let the squirrel be hauled up to the top of his wheel; will he then turn it? No, "*he'll be hanged first.*" How then could Mr. Mackintosh, his magnet being powerful enough to suspend his bullet and thereby nullify its gravity, still expect that the said gravity, so annihilated, would exert its power in causing the descent of the wheel? There is not the slightest intimation that Mr. Mackintosh ever thought of reversing or cutting off the poles of the magnet, which alone could have made his plan even commonly plausible, but which even then would have been immeasurably inferior in point of ingenuity to Mr. Baddeley's pendulum, or to a thousand other similar ideas which have long since appeared in your Magazine.

Had not Mr. Mackintosh's name and authority been appended to this plan, and did he not evidently, fron the whole tenor of his communication, still retain all a father's fondness for the bantling, I had never wasted so many words upon it. And here let me remark, that I was *rather* surprised to read the elaborate refutation which Kinclaven, at page 148, thought it necessary to give to O. N.'s most absurd conclusion about the latitude of London and the pole-star (page 116); surely in this case, at least, "*Le jeu n'en vaut pas la chandelle.*" Never in this world was absurdity branded in more glaring colours on any proposition, being neither more nor less than that the pole-star would, in a certain year, be at the same instant both *north* and *south* of the zenith of London.

First, it is stated that in the year 15,064, the pole-star will be 8° 56′ 49″ south of London; and next, that this very zenith distance will regulate the latitude of London, which will then be 90—8·56·49=81° 3′ 11″.

Now, this last could only be the case on the supposition, that the north pole and the north star are one and the same; and if so, the north star must then be to the *north*, at the same time that it is stated to be to the *south*.

Hence, it is clear that this "*practical*" astronomer confounds the pole of the earth with the star which is now called, "*by courtesy*," the pole-star, but which must resign that distinction long before the period he refers to; and, as if to afford ample proof of the utter confusion of ideas with which he approached the subject, after stating that the latitude of London in the aforesaid year will be 81° 3′ 11″, a little lower down he makes *the declination of the zenith of London 51° 32′ at the very same time.*

By-the-bye, Mr. Kinclaven himself may be caught napping now and then; for instance, what does he mean by talking of the pole-star's distance from the *tropic of Cancer?* The tropic of Cancer is a *small* circle, while he means it for a *great* one, and a *parallel of declination* while he means it for a *circle of longitude.* And again, like O. N., he talks of the *pole's declination*; but, most probably, this latter is an error of the press.

I am, Mr. Editor,

Your obedient servant,

NAUTILUS.

Dec. 11th, 1838.

PRINTING IN COLOURS.

We are glad to see that Mr. Baxter has, at length, adopted a plan of applying his new invention of printing engravings in colours, which must at last bring it fairly before the public. The attention of every one who professes the slightest regard for art, *must* be attracted by his new *Pictorial Annual*, with eleven plates, in which the minutest shades and tints in the paintings of eleven distinguished artists are re-produced, with a spirit and delicacy which must render it difficult to distinguish the copy from the original. The invention has now, indeed, been applied for some time to the illustration of a series of works on natural history, &c., by Mr. Mudie and others; but so little noise hitherto has been made about the matter, that apprehensions might reasonably be entertained that the process might be invented anew at Paris, amidst a flourish of trumpets, and some Parisian company present a petition to Parliament (backed of course by the *Athenæum*) for a few thousands, by way of recompense, for borrowing the idea. In this case, however, the Parisians might lay some claim of priority, for twelve or thirteen years ago they actually did spread a report of having invented a process for printing lithography in colours, to which they gave the name of "Lithochromy." The secret history of this affair has been

revealed by the German artist, Zahn (the same so often mentioned in the report of the late Committee on Art), who communicated a short sketch of his own artistical experience to a review of a work he published on Pompeii, which was written by no less a person than Goethe, and appeared in the *Vienna Annals of Literature (Jahrbucher des Literatur)*, No. 51, for July, 1833. Zahn informs us, that when he was at Paris in 1824, a lithochromic establishment was flourishing in full splendour on the Quai de la Seine; and it was extremely fashionable, among foreigners and strangers, to purchase a few specimens of the new invention. Becoming acquainted with a number of young artists, however, he soon got behind the scenes, and found that the whole art and mystery of lithochromy consisted in covering lithographs with a sort of varnish, and then colouring them in the usual way; that, in fact, the new invention was a downright swindle. When this became pretty generally known, as it soon afterwards did, the establishment was discontinued, and lithochromy no more heard of in France; but, on Zahn's return to Berlin, he found the productions of the new art still in request among the amateurs of the Prussian capital, and his statements were treated with disregard. It was impossible, they told him, to believe that human impudence could be carried so far as he asserted, even at Paris; and he was accordingly disbelieved, till his account of the humbug was confirmed by Alexander von Humboldt. All this is told by Zhan in a preface to the declaration that, in his own work on Pompeii, the coloured engravings introduced are in reality printed in colours, by means of a process invented by himself; and he concludes by observing, that if he were to bring this invention into use at London or Paris, he has no doubt he would soon acquire a fortune; but, from a feeling of patriotism, he prefers confining it to his own country, in which he seems to insinuate that patronage is scarce. How far his expectations of profit would have been justified, it is not easy to tell. Mr. Baxter must be the best judge. From the circumstance that in England the process is applied to wood-cut engravings, there is probably a good deal of difference in the inventions.

THE BRITISH MUSEUM.

The "Note" on the British Museum, copied from the *Standard* newspaper into No. 694 of the *Mechanics' Magazine*, is not remarkable for correctness. The Italian workmen employed in taking casts in the Elgin Gallery do not take such "jealous care" as is represented, to prevent either the mode or the materials employed from being discovered; for although the canvass screen by which they are surrounded is impervious to the eyes of the public, the officers of the Museum are not precluded from visiting the interior. That the public should thus be deprived for a length of time of the view of some of the most celebrated statues in the Museum, or the world, is itself a sufficient ground of complaint, without any need of aggravation. These artists should have been directed to reserve their very exclusive labours for the month in which the establishment is shut up. The casts are being taken for the King of the French. The "200 specimens" of the most beautiful Etruscan vases compose about half the collection lately purchased from that of M. Durand—united to those of Sir William Hamilton, they will form the finest in existence. The mummies purchased from Mr. Salt's collection of Egyptian antiquities are only part of some extensive additions in that department lately made to the Museum, amongst which the sarcophagus presented by the Duke of Hamilton, and the curious model of an ancient Egyptian house, will not form the least prominent. "Within the last twelve months the Library has received several valuable additions," but, it may be added, not one-fifth of what it ought annually to receive; and the collection of "newspapers of the United Kingdom," which, in "rich bindings, gilt and lettered," seems to absorb so much of the admiration of the writer in the *Standard*, was arranged in the Reading-room long before the time he mentions, as well as the Arundel manuscripts. Among the really recent additions to the manuscript department, it may be added, are some most valuable collections of Spanish state documents, sufficient, in fact, to furnish employment for an inquirer into Spanish history for years to come. One quarto volume is wholly occupied with papers respecting the battle of Trafalgar; some

of them printed plans of the battle, &c., published in Cadiz at the time, but most of them manuscript communications from naval captains, eye-witnesses of the combat, &c. to the Spanish Ministry. Another volume, in folio, consists of documents relating to the surrender of Madrid to Napoleon. To playwrights in want of a plot, it may not be uninteresting to learn that there are also three manuscript volumes of Spanish comedies, some of 200 years old, in the hand-writing of the authors, and several of distinguished merit. In fact, the manuscript collection of the Museum is a mine of inestimable value; and it may in some degree alleviate the mortification of an Englishman, who reflects that the libraries of Gottingen, Munich, &c. surpass the national collection of his country in printed books, to know, that the assemblage of manuscripts at the Museum is probably only excelled in value by those of the Vatican and the Royal Library of Paris.

NOTES AND NOTICES.

City Improvements.—Improvement is progressing, although perhaps not quite so rapidly as might be desired, at the top of Cheapside, between St. Martin's-le-Grand and St. Paul's Church-yard. The toy-shop at the corner of Paternoster-row is already set back, and the houses between that and Newgate-street pulled down, so that the whole effect of the intended alteration is visible—and most particularly visible is it, that it will be of a very half-and-half character. Sooner or later, it appears quite evident, that the whole clump must be set back so far as to be in a line with the western side of St. Martin's-le-Grand, thus opening a view of St. Paul's from the front of the Post-office. It is rumoured, indeed, that the City improvers see so clearly the insufficiency of their pullings-down in this quarter, that they have already decided that the newly-built toy-shop must come down again immediately, to be set further back! In that case, of course, the medicine-warehouse at the opposite corner of "the Row" must be considered a "doomed house!" The best way would be to "go the whole hog" at once, and not incur useless expense by *nibbling* at an indispensable improvement.

Lace-Sewing in Hamilton.—About 100 years ago the Duchess Ann of Hamilton, then residing in France, visited some of the lace-factories, and was so much taken up with their mode of teaching the art, that she brought a native with her to Hamilton to teach the poor children there. She also brought over some patterns, and even drew some new ones to please her own fancy. One of these new patterns she named Hamilton lace, and appeared at Court with her dress ornamented with it. In a short time the higher classes all ordered "Hamilton lace;" and the demand soon came to be so great, and the price so encouraging, that both rich and poor about Hamilton learned it and worked at it—the one for pleasure, and the other for profit. As it was considered no disparagement for a merchant's wife or daughter to take lessons from the Duchess, the trade continued to do much good to the town. About the time the weaving of cotton cloth came to be so extensive, the lace came to be dull, and the women found it necessary to turn their hands to the flowering of muslin. At present there are only three or four old lace-workers in Hamilton. A few years ago a spirited company in Nottingham sent down from thence a man and two girls to Paisley, to get the lace flowered and tamboured; but he could not get hands in sufficient numbers, and had lost all hopes of getting them in Scotland, when some person spoke of Hamilton. He took the hint, and pitched his camp in that town, and he, with his two assistants, soon got plenty of good hands, and for some time he kept the trade wholly with himself, on account of the difficulty of finding thread. Now it has got into a circle of other merchants and agents, who employ more than 1000 workers in and about Hamilton. Veils, tippets, caps, and full skirts of all patterns and colours, have been exported to all parts of the world; and, though prices have fallen considerably, the women employed make good wages yet.—*Glasgow Chronicle.*

Discovery in Effacing Writings.—A simple preparation has been discovered by which the writing with all sorts of ink (except Indian ink used for drawing) can be effaced, so as not afterwards to be known that it has been so, is about to be made known to the public. The moment this discovery is so made known, there will be no security for any one against having his simple signature to a letter being made a signature to a bill of exchange, or obligation for a large sum of money. For this discovery which has been made has this peculiar characteristic about it, that a portion of the writing may be effaced, and such portion as the effacer thinks fit preserved, and yet the portion of the paper from which the writing has been effaced look precisely the same as to colour and appearance, and may be just as easily written upon afterwards, as if it had never been effaced at all.—*French Paper.*

New Material for Lighting.—A chemist of St. Amand, in the Nord, France, is said to have discovered a means of extracting from the water in which wool is washed, the grease which escapes from it, in great quantities, during the operation, and of making from it a cheap material for lighting the dwellings of the poorer classes.

The Supplement to Vol. XXV., containing Title, Table of Contents, Index, and Plate of Specimens of English Medallic Engraving by Mr. Bate, was published on the 1st of December, price 6d.

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Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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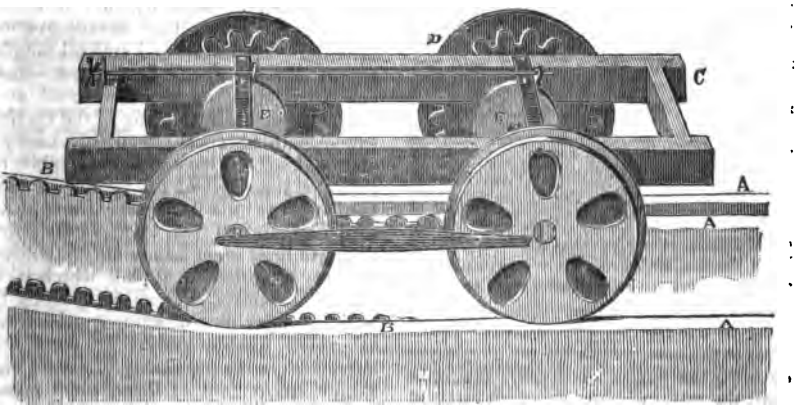
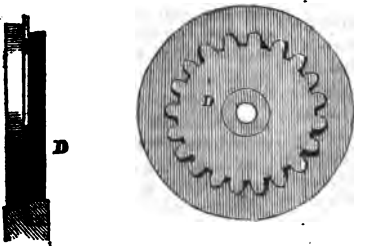
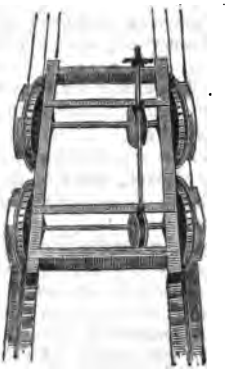
WOOD'S IMPROVED LOCOMOTIVE-APPARATUS.







WOOD'S IMPROVEMENT IN LOCOMOTIVE-APPARATUS.

The prefixed drawing represents the frame of a locomotive-engine carriage, the wheels of which are of a compound description, having teeth or cogs on the inner side, and made in the ordinary form on the outer side, with a rim or flange in the centre: the iron railway on which it is intended to traverse does not differ in any respect from the most approved rail in use, so long as the line is perfectly horizontal; but, when it is desired to change the level of the railroad, a compound rail corresponding with the wheels must be laid down, at a suitable angle (about one yard in ten), so that the wheels of the locomotive-engine may be then assisted by the cogs: these cogs should also extend on the horizontal line both above and below the angle required to the full length of any train to be drawn on the rails, in order that the engine may have the assistance of their fulcrum until the last carriage has passed the angle of ascent. And when descending, the cogs must in like manner extend on the lower level to the same length for the purpose of enabling the engine to support the train until the last carriage has again reached an horizontal line. In all cases the weight of the carriage rests upon the plain surface—the cogs merely acting as fulcrums to assist the engine. I prefer the cogs to be made of wrought or beaten iron.

A comparison has been urged in favour of stationary-engines over the plan now shown.

1st. The outlay for the erection of stationary-engines is one item of considerable expense.

2dly. In many situations the coal is very expensive, and all that is consumed must be to the full value thereof an extra expense.

3dly. An establishment of engineers and firemen at every station is also an extra and constant expense. The delay of attaching and detaching the trains (granting the steam to be always in readiness), and the possibility of the breaking of chains or ropes are contingencies worth consideration.

This plan offers the advantage of such strength and simplicity, that no engineer can possibly make a mistake in ascending; for he has nothing to do, nor will the train be required to stop one moment. The steam with which the train moves is always ready, and the action of the cogs follows the plain surface imperceptibly. In descending, the engineer has only to turn the handle of a screw, which acts upon powerful breaks on both axles, so as with ease to stop the whole train in the middle of a descent if required, or to regulate the speed with the greatest precision.

It cannot be necessary to say one word upon the enormous saving of expenses in laying down railways which this mode affords; nor upon the advantages of avoiding both tunnels and embankments. Kilsby Tunnel on the Birmingham line, and Chat-Moss on the Liverpool and Manchester, are specimens of the fearful expenses to be encountered. Noblemen and country gentlemen are quite able to judge of the effect of a long line of embankment in the prospects from their mansions, and on their sports in the field.

These brief remarks are only intended to draw attention to a plan which it is hoped has merits sufficiently obvious to meet all objections which may arise from interested motives only. To *bonâ fide* shareholders the possibility of saving one million sterling out of three, must be an object worth their consideration.

Description of the Engraving.

AAA represents the ordinary horizontal rails; B, iron rails, having, in addition to the ordinary smooth surface, an inner line of teeth or cogs, and laid down at an angle of 1 in 10, which combined rail must be continued above and below the rise required to the length of any train of carriages which may travel thereon, and the cogged or toothed part must feather off at the extremities; C, a frame on which a locomotive-engine would rest; DD, iron wheels, having the inner side cogged, and the outer side plain with a rim between; EE, breaks, attached to one or both axles, to regulate the speed when going down hill.

HENRY W. WOOD.

29, Austin-friars, London.

[We publish Mr. Wood's "Improvement in Locomotive-Apparatus" from a desire to let the mechanical world know every thing, of even apparent utility, which has been proposed for rendering either more economical, or more effective, the grand system of national intercourse to which it relates, rather

than from any high opinion of its merits or of its originality. The plan of "mixed railways" has already been proposed and discussed in our Magazine some years ago. We refer Mr. Wood, and whoever else it may concern, to an article in vol. xiii. p. 265, in particular. The following extract from this article will show that there is nothing new in Mr. Wood's plan:—"It consists in the mere addition to the outward edges of the rails on inclined planes of a raised flange or range of cogs, and of corresponding cogs on the power-wheels on the locomotive-engine, at a proper distance from the rim of the wheels to work in the interstices of the cogs on the rails." Several methods of applying the suggestion followed, and, amongst others, one by Messrs. W. and J. Hopkinson, which is almost a fac-simile of Mr. Wood's (see vol. xiv. p. 120). See also the same volume, pp. 24, 159, 213, and 304. A plan very similar was also communicated to us (though not for publication) several months ago by Mr. Tait.—Ed. M. M.]

"HOUSE-BURNING SYSTEM."

Sir,—Facts are universally acknowledged to be very stubborn things, I have therefore sent the following for Mr. Baddeley to digest (if he can) during the leisure of the Christmas holidays:—

"Destructive fire at Messrs. Faulkner and Owen's cotton-spinning factory, Manchester. When Mr. Rose, conductor of the fire-police, arrived with the town engines, he found the whole of the upper part of the factory one volume of living fire, and the flames spreading with the utmost rapidity. The people were hurrying, men and women nearly naked, and their children clinging to them in terror, were seen only now escaping from the fatal pile. *When the engines arrived, none of the disposition to aid the firemen, which ordinarily exhibits itself among the people, was manifested by them; they stood entirely aloof, and if at all asked to give a helping-hand, remained either doggedly silent and inactive, or vented some unfeeling expression against Mr. Faulkner.* The loss of property is estimated at from 10,000*l.* to 15,000*l.*—Manchester, Dec. 10."

Good, Mr. Baddeley; would any entreaty for assistance have been necessary to this cold-blooded vindictive mob if Mr. Braithwaite's steam fire-engine had been the town's engine instead of the (in this case, at least,) useless squirts they possessed—*au contraire*, without any appeal to such scoundrels as must have composed that mob, and may compose others hereafter, in Manchester and other great manufacturing towns, where differences exist between master and workman—"Swing" having stepped in to aid the latter in his system of intimidation—the steam fire-engine would, without aid being required from any, have done its work nobly, and been the means, probably, of saving considerable property.

Oh, Mr. Baddeley, may we be delivered from such fire-extinguishers as are the different companies which you have taken under your steel (pen's) protection—they are unworthy of your talents—give them up, or they'll drown you for pure love some day in one of their buckets.

I am, Sir,

Your obedient servant,

FIRE-FURY.

THE RELATIONS BETWEEN THE PUBLIC AND INSURANCE-COMPANIES FURTHER EXPLAINED.

Sir,—I am sorry I cannot congratulate "Fire-Fury" on the clearness of his perceptive powers, in return for the title and compliments he has lavished upon me in your last Number; had he carefully perused my communication on the relation in which the public and the Insurance-Companies stand to each other, at p. 157, he would have found a clear and explicit answer to all the questions which he has thought proper to put to me at p. 179. However, I am extremely anxious that every person should fully understand what these simple relations, in fact, really are; I, therefore, willingly take up my pen to endeavour, if possible, to put the matter in a still clearer point of view.

To question the first (vide p. 179), from my own personal knowledge, I answer YES. The formation, by the Insurance-Companies, of *the London Fire-Establishment*, and the history of its proceedings and performances for the past four years, establishes this fact. Every nerve has been strained to render the Fire-engine Establishment as efficient as possible; numerous improvements have been introduced from time to time—many

others are even now in course of adoption.

A new and powerful floating fire-engine is being constructed, calculated to render most effectual assistance at all river-side fires; and no expense consistent with the extent of business done has been spared to render both the men and machines of the Establishment as efficient as possible.

Further, I am quite certain that should any person be able to produce any *more efficient* machine than the present fire-engine, the latter would be immediately superseded. Having thus far fully, and I hope satisfactorily, answered the first of "Fire-Fury's" questions, I would merely ask, in return—What, but the patronage of the Insurance-Companies has brought the fire-engine to its present convenient form and highly efficient state? Who were the principal encouragers and supporters of Newsham, of Simpkin, and their successors?

The second question, relating to Mr. Braithwaite's steam fire-engine, might be answered by simply stating, "that ALL *do not* admit (some even deny it) of its being an effective instrument, and *therefore* it has not been adopted." The fact is, that in this, as well as in every other machine hitherto applied to the extinguishing of fires, gain of power has always been attended with more than an equivalent loss of time; and experience proves to demonstration that *time* is of infinitely greater value than even *power* in fire-extinguishing machinery. Were the Directors of the Insurance-Companies as well satisfied as "Fire-Fury" appears to be, of the *effectiveness* of the steam fire-engine, I am certain their own interest would dictate its adoption. For my own part, I am of opinion, that a steam fire-engine would prove a valuable auxiliary at *large* fires, *whenever a sufficient quantity of water* could readily be obtained to supply it; but these instances are so "few and far between," that I confess I am not surprised at its non-employment. I fancy very few of those who talk so much about Mr. Braithwaite's fire-engine, know any great deal about its real effectiveness. I apprehend they will be somewhat astonished when told, that two of the Establishment fire-engines, with their hose united, will exceed the performances of the *steamer*; this they have done at more than one fire where they have been engaged. If the Insurance-Companies choose to pay for *manual labour* in preference to *steam-power*, so be it, 'tis their own business. I reckon, they calculate the former (all things considered) the most economical, and I also guess they are not far wrong. However, I shall not stop to discuss this question in detail now, as it necessarily forms part of my promised communication on "the relative usefulness of different sized fire-engines," which shall be forthcoming so soon as I can obtain the leisure necessary for its completion.

With respect to question No 3, I shall most likely be able to afford some of the information required, in my annual report of London fires for the present year, now in course of preparation. Some of the information called for, however, it is not possible to obtain, the losses of the *uninsured* being known to *themselves* alone; the losses of the *insured* are borne in various proportions by different Fire-offices, and only to the amount for which insurances have been effected—all loss beyond that being in effect *uninsured*.

The amount of property in the United Kingdom standing at the risk of the Fire-insurance Companies in 1835, was upwards of five millions sterling, nearly four millions of which was insured by the London offices. The "*tax upon prudence*" received by Government, in the shape of duty, amounted to 767,280*l.*! for which not one jot of protection was in any shape afforded.

"Fire-Fury," in a most unfortunate spirit, speaks of "exposure that would lead to public reprobation." Exposure! what is there to expose? Is there any secret or mystery about the theory or practice of fire—or, indeed, of any other insurance?

Is there any close, impenetrable monopoly in this business? Is any person or persons prevented from opening an Insurance-office to-morrow, if they think proper so to do? And is it really such a profitable speculation as justly to excite envy? I know people are very apt to think it is, and yet what is the fact? Why that within a very few years past, no less than *twenty-five* offices have declined *fire-insurance!*

Competition has done, and will ever continue to do, its office, in this as in all other trades, and the effect has been so to proportion the premium charged to the

risk incurred, that any attempt at further reduction has proved ruinous to the insurers.

Public reprobation looks well in print, but what is the sense of the conjoined words as used by our "Fire-Fury? Who are the public to reprobate—and for what?

The *insured* public have as yet no grounds for reprobation; if called upon, the Fire-offices might say to them, "We do our very best to protect you from damage by fire; but if we fail, we repay your loss to the extent of our mutual bargain.

The *uninsured* public are in no position to inflict reprobation; it is true they may say to the Insurance-Companies, "We do not choose to come to your shop, nor to have any dealings with you, we think proper to bear our own risk; but mind, you will please to provide firemen, engines, aye! and steam fire-engines too, for our protection—not out of the sums paid as premiums, for we pay none—but out of your own private pockets! Hereof fail not, or beware of *public reprobation!*"

"Fire-Fury" gives me credit for "knowing more of this matter than the commonalty do." Perhaps I do, at least I have made it my study, without being in any way favoured; all may know as much as I do, if they will take a little trouble. The question is not a difficult one, nor is any concealment practised; were it so, none would wage such deadly war with it as your humble servant.

In this, as in all previous matters with which I have been induced to mix myself up in your pages, I have never curried favour of any person, nor have I flattered any one from a hope of gain—nor concealed the truth from fear of displeasure. "Honest and fearless" I have ever been, and I hope "Fire-Fury" will give me credit for steady adherence to these principles in the present communication.

I hope shortly to return to this subject, with new facts and additional information; meantime, I would again request a careful perusal of my last communication, which really embraces the whole topic of discussion, and answers every question of principle, that can be proposed.

I am, Sir, yours respectfully,

WM. BADDELEY.

London, Dec. 14, 1836.

REPORT OF THE COMMITTEE OF THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS, ON THE EXPLOSIONS OF STEAM-BOILERS. PART II.,* CONTAINING THE GENERAL REPORT OF THE COMMITTEE.

(From the *Journal of the Franklin Institute.*)

The Committee appointed "to examine into the causes of the explosions of the boilers used on board of steam-boats, and to devise the most effectual means of preventing the accidents, or of diminishing the extent of their injurious effects," respectfully submit to the Board of Managers of the Franklin Institute, the following Report:—

The Committee undertook the task imposed upon them by the Franklin Institute, with a deep sense of the responsibility which it involved. On the one hand, a series of disasters by which human life was sacrificed, called loudly for an investigation of the causes which produced them; on the other, an untimely or ill-directed interference with a branch of industry, which has been a source of unparalleled advantage to our country, was truly to be deprecated.

Emanating from an Institute "for the promotion of the Mechanic Arts," the Committee felt advantageously situated. They could not justly be suspected of a desire to trammel the progress of any art; and yet the public confidence, which had always been accorded to the institution, would naturally attach to a Committee selected by it.

The Committee further believed that the apprehensions of the public, aroused by the frequent recurrence of accident, could only be satisfactorily allayed by an investigation, which would show that such accidents were not unavoidably incident to the useful agent which they distrusted, but resulted from a want of due regulation of its power, or from circumstances incidental to its use which could be foreseen, and therefore guarded against. If disappointed in this anticipated result of investigation, the Committee hoped to satisfy those who are public carriers, that it was their duty to provide protection for those who trust life in their hands, against an agent thus found to be uncontrollable.

With these views the Committee commenced, actively, the collection of information upon the subject intrusted to them. The

* For Part I. see *Mech. Mag* Vol. XXV. and *Franklin Jour.* Vol. XVII.

replies to their circular were canvassed in their meetings, and finally laid before the public.* It occurred most opportunely for the ultimate success, though not for the rapid completion of their labours, that an opportunity was afforded them for experiment, by which to test many of the suggested causes of, and preventives to, the explosions of steam-boilers.

These experiments, originally proposed by our public-spirited fellow-citizen, S. D. Ingham, Esq., then Secretary of the Treasury of the United States, have been brought to completion, and presented to the public under the auspices of the present secretary.†

The Committee trust that they have, by the experiments just referred to, shown not only what are some of the causes of explosion, but, which is quite as important, what are certainly not causes. In this way they hope to have turned away the attention of ingenious men from false hypotheses which cannot furnish the remedies they are in quest of, and to have pointed out some directions in which their labours may be profitably bestowed.

A desire to complete the reports upon their experiments, has induced a delay in the present Report, which, thus far, however, the Committee are satisfied will be found to have been judicious. This conclusion they rest upon the many references, which will appear in the following pages, to those experiments, which have given an authority to recommendations and suggestions, that could not have been claimed for them unless thus strongly supported by facts.

They regret much that the part of their Report referring to the strength of materials will, from circumstances, be unavoidably incomplete. This deficiency, they hope, will hereafter be made up, the experiments on the subject having been some time since concluded; and they do not feel warranted, by this cause, in any longer delaying their general Report.

In this Report the Committee have endeavoured, by examining the different accounts of explosions on record, and the writings on collateral subjects, to ascertain what causes have been operative in producing these disasters. The difficulty of procuring satisfactory testimony in regard to them, has been often pointed out. Most frequently those from whose mismanagement or want of vigilance they have immediately resulted, have been victims to them, and when they have survived, the precise state of things before the occurrence was imperfectly known to them; and, however honest, their minds have received a bias towards the non-existence of certain circumstances judged likely to have produced the results.

It hence follows that in regard to many explosions, either none of the circumstances which immediately preceded them, and bearing upon them, are known, or by inaccurate statements of them, an appearance of mystery is thrown around the whole matter, calculated to baffle research, and to alarm the community, who are exposed to a recurrence of the same dangers. Thus it happens that of the numerous explosions on record, few are made to subserve the cause of humanity, by a knowledge of their proximate causes. The details of the number of killed and wounded, and of the more or less entire destruction of the boilers and of the boats, are given in the daily prints, and public curiosity is satisfied.

In making their examination, then, of the cases of explosion, the Committee have selected such as they have found most directly to the points in support of which they are cited; omitting others in which the facts are less clearly made out, or in which the causes assigned may be resolved into matters of opinion. Having themselves no theory, or theories, to support, they have of course not been biassed, by such views, in the selections made.

This mode of proceeding is, obviously, not calculated, by one effort, to exhaust a subject. But the Committee believe, that they are able to make a decided step forward in the knowledge at present existing, in a connected form, on this subject. That to the causes pointed out by a Committee of the British House of Commons,‡ in 1817, namely, improper construction or material of a boiler and undue but gradual increase of pressure, they will be able to add others as important, and as fully proved as the former. Nor will any cause for alarm result from this extension, since it will be found that it is only ignorance of these circumstances which constitutes their danger, and that they may be prevented from occurring and remedied when they occur It will be full time after the well-ascertained causes of explosion have been duly guarded against, to look for others more occult in their nature, if, indeed, there are such.

In the following Report, the Committee propose to examine separately the circum-

* As these replies will be frequently referred to in what follows, it is proper to state here, that the references are made to the pamphlet distributed by the Committee to their correspondents and others, and that Nos. I. to XIII., both inclusive, were published in the *Journal of the Franklin Institute of Pennsylvania for the Promotion of Mechanic Arts*, Vol. VIII.; Nos. XIV to XXVIII., both inclusive in the same Journal, Vol. IX.; No. XXVIII. Part II., and No. XXIX., in Vol. X.; and No. XXX. in Vol. XI.

† Hon. Levi Woodbury, for whose promptness in forwarding their views, the Committee beg leave ere to return thanks.

‡ Charles Harvey, Esq., Chairman.

stances which they consider as the proximate causes of explosions in steam-boilers, and the preventives or remedies which have been proposed to meet them. Under each division of the subject they will make the suggestions or recommendations to constructors and others, which they base upon the previous discussion; and at the close of the Report, will present a project of a law for carrying into effect, in regard to steam-boat boilers, those recommendations which are of primary importance.

It will be observed thus, that while they do their duty to the arts by pointing out as far as their knowledge extends what they consider improvements or valuable alterations, they do not propose to render imperative any measures but such as are required for public safety.*

In submitting this project the Committee obviously do not entertain a doubt of the competency of Congress to legislate on the matters embraced in it. The several discussions in that body on the subject,† the recommendation of the President of the United States,‡ and especially the very detailed provisions of the bill recently proposed in the Senate, fully sustain them in this opinion. They consider the question now to be, not whether any regulations may be made, but how those to be made may be rendered most efficient and complete. For this completeness the very respectable Committee§ who reported the bill referred to, in the Senate of the United States, have expressed themselves anxious; and the labours of this Committee, so far from being an interference, will no doubt, as far as they may be approved. be looked upon as forwarding the views thus expressed.

The good effects which have attended the adoption of partial preventives in England, and the excellent effects from the more complete ones in France, should urge us, as Americans, to do our part in preventing further destruction of life and property by these disastrous explosions. And while we apply means for this purpose, experience and reason both teach us that they will produce no undue or severe restraints upon mechanical skill or commercial enterprise, but rather that they will aid both, by increased confidence on the part of the public.‖

The Committee propose to investigate the different causes of the explosions in steam-boilers under the following general divisions.

I. Explosions from undue pressure within a boiler, the pressure being gradually increased.

II. Explosions produced by the presence of unduly heated metal within a steam-boiler.

III. Explosions arising from defects in the construction of a boiler or its appendages.

IV. Explosions resulting from the carelessness or ignorance of those intrusted with the management of the steam-engine.

V. An examination of the particular cases of collapse of a boiler, or its flues, by rarefaction within.

I. Explosion from undue pressure within a boiler, the pressure being more or less gradually increased.

1. This is one of the most natural causes to look to as producing the bursting of steam-boilers, and one which, probably, is as frequently operative as any other. It might be supposed that with a safety-valve always applied and a mercury gauge so easily applicable, the low-pressure boiler should have been exempted from explosion. But such has never been the case, and we find a Select Committee of the British House of Commons, in 1817, specially directing their inquiries to the cause above stated, as producing the disastrous explosions which, even at that day, called for legislative interference.

2. That a gradual increase of pressure can produce all the effects of the most violent explosions, may be inferred from many cases on record, attributed with probability to this cause; and was proved conclusively by the direct experiments of this Committee. In these latter, cylinders of copper and iron were violently torn asunder, the parts thrown from their places, scattering the materials of the temporary furnaces over which they had been heated, and of the fire, to considerable distances.¶ There are also cases well

* This project is put forth with a view to free discussion, without which the Committee would feel entirely unwilling that it should be adopted. They propose, with this view, to distribute it as widely as possible, and invite especially a discussion of its provisions, in the *Journal of the Franklin Institute.*

† See Act regulating steam vessels, proposed in 1824, mainly founded on the action of the Committee of Councils of Philadelphia; and especially the Report of Mr. Wickliffe, from a Select Committee of the House of Representatives, May, 1832. [Pub. Doc. Rep. No. 478.]

‡ In the annual message for 1833.

§ The Committee on Naval Affairs. Hon. Samuel L. Southard, Chairman.

‖ Professor Silliman, in an article on the safety of steam-boats, has the following strong expression of opinion:—"The boat which is first ascertained to afford absolute security will be a fortune to its proprietors."—Silliman's Jour. Vol. XIX. p. 140.

¶ This effect is well illustrated by the rendering of a copper cylinder just referred to. The subjoined figure and extract are from the first part of the Report of the Committee on Explosions, &c. p. 68. (*Jour. Franklin Institute*, vol. xvii. pp. 224, 225.

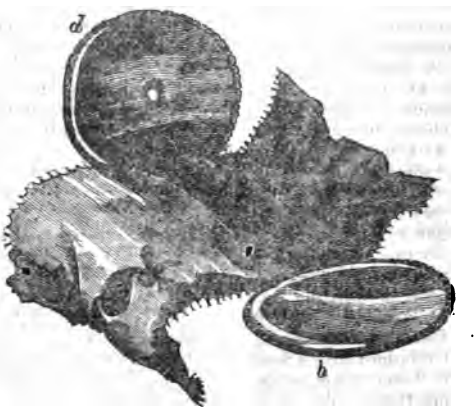
"As before, nothing remarkable occurred previous to the instant of explosion, and the members of the Committee, employed in the experiments, were engaged in observing the boiler at the instant it exploded. A dense cloud of smoke and flame, capped by steam, rose from the pit; the stones and

made out in which a weak place in a boiler has acted as a safety-valve, but such fortunate circumstances are not always to be looked for, and better methods have been devised of effecting the same object, than to imitate them by the use of thin plates. The idea stated to be current,* namely, that a boiler does not explode if duly supplied with water, is wholly untenable and highly mischievous in its tendency.

3. We are warranted, then, in looking to the failure of the apparatus designed to prevent undue pressure, or to the misuse of it, as the cause of explosions of the most violent kind. The current of testimony is too strong to permit the former view to the exclusion of the latter. It has been too clearly shown that those who have charge of the steam-engine sometimes not only neglect the means of safety provided, but actually render them inoperative. Not to multiply instances, the Committee refer to the following as entirely well made out, and in which the connexion between the misuse of the means of safety and the explosion is fairly to be inferred. First, That of a cast-iron boiler used in a sugar-house in Wellclose-square,† London, the mercury gauge attached to which was plugged up and the safety-valve purposely overloaded at the time of explosion. Second, The case of a steam tow-boat on the Rhone,‡ in France, when the safety-valves of the four boilers were fastened down, so as to be immovable. Third, The explosion of one of Trevithick's locomotives,§ when the safety-valve was kept down to raise steam at starting. Fourth, The explosion in the steam-carriage of Messrs. Burstall and Hill,‖ when in going over a soft piece of road, in which the coach laboured, the engineer kept down the safety-valve, by pressing upon the lever. And fifth, The explosion of the boiler of the

combustibles were widely scattered, and the boiler was thrown, in a single mass, about fifteen feet from the furnace. The noise attending this explosion was like that from the firing of an 8-inch mortar.

"The boiler was rent as shown in the accompanying figure, giving way in an irregular line, just above the probable water line on one side of the boiler, but not conforming to it. *d* and *b* were the lowest points in the two heads before the explosion. The sheet of copper was torn from the heads, enrolled and irregularly bent, adhering to the heads



for only a short distance near the top of each; and the heads were bent outwards. The thickness of the copper along the line of rupture varies from 0·25 to 0·35 of an inch, and the metal appears to have been highly heated at one end of the torn portion."

* Replies to Circular of Committee on Explosions &c. No. XII. Report of Thos. Bakewell, Esq.—"at a subsequent period and after the explosion I had conversed with some of those who contend that a boiler cannot burst with 'fair play,' as it is termed."—To meet this prejudice, the Committee have chiefly selected their proofs from accidents which have occurred abroad.

† Minutes of evidence before a Select Committee of the House of Commons, &c. &c. by Geo. Dodd, Civ. Eng. Evidence of Mr. Braithwaite, Mr. Richter, &c. Also, Partington on the Steam-Engine.

‡ Annuaire du Bureau des Long., 1838, p. 141. Jour. Frank. Inst. vol. v. p. 401. It is stated in the London Jour. of Arts, that the pistons of the engine had become fixed in the cylinders by being expanded more rapidly than these latter, and that Mr. Steele, the manufacturer of the engine, supposed the steam to be insufficient, and was induced by the desire to have his engine succeed, to adopt a device which resulted so fatally. London Jour. Arts, vol. xiii. p. 346.

§ Minutes of Evidence, &c. Evidence of Mr. Chapman.

‖ Reply to Circular of Committee on Explosions by L. Hebert, Esq., of London, No. II. See also the bursting of one of Hancock's boilers, from the fastening down of a safety-valve. Lond. Mech. Mag. vol. xviii., and Jour. Frank. Inst. vol. xi. p. 277.

steam-boat "New England" from a "pressure of steam, produced in the ordinary way, but accumulated to a degree of tension which the boilers were unable to sustain."*

4. If the apparatus devised for the low-pressure boiler has been rendered inoperative, the high-pressure boiler has had to contend with peculiar difficulties. No gauge applicable to it has yet been brought into use. The open gauge must be of undue height, or cumbrous in its serpentine form; and the closed gauge requires great nicety in construction, and a correction for the temperature of the air enclosed in it. A graduated safety valve would give the engineer desirable information, and has been to a certain extent used. The engineer of a locomotive-engine, where the spring weighing-machines are used with the safety-valves, has it in his power to ascertain, at any moment, the pressure within the boiler.

He has, it is true, besides, the power of keeping the valve down even when the pressure within may be unsafe, but then he and his assistants would probably be the only victims of its abuse.

5. The extraordinary and fatal increase of pressure which the Committee have above shown to be produced designedly at times, has at others been attributed to the adhesion of the safety-valve. A practical engineer, Mr. John B. Calhoun, has given a remarkable instance of this kind† as occurring to a safety-valve on the boiler of the steam-boat "Legislator," then navigating the Hudson. The mercury-gauge indicating an undue pressure within the boiler without the raising of the valve, the engineer endeavoured first to raise it by a cord which passed into the fire-room: failing in this he went to the top of the boiler where the valve was, and moved the weight upon it towards the fulcrum, but without effect. He then applied his force at the end of the lever to raise it, when suddenly the valve opened with a loud report, and the flow of steam commencing, lasted some time before the elasticity had diminished to its usual degree.

6. In this case, there can be but little doubt that the valve had corroded upon its seat, or was fastened by the drying of oil, or other matter, to it. The carelessness of the fireman who had charge of the boiler, and whose duty it was probably to raise the valve from time to time, is fully proved by his allowing the steam to get so high, that the rod of the mercury-gauge was against the boiler-deck, without giving notice to the engineer. Had not the latter observed, from the rapid working of the engine, that the steam was high, and investigated the matter, the lives of many would, no doubt, have been sacrificed.

7. The experiments made by M. Clement Desormes‡ on the tendency of disks, when placed in front of an aperture, through which air is forcibly issuing, to approach it, led him to condemn the safety-valve entirely, and especially the disk form. This sentence does not seem to the Committee to be just,§ since the tendency upward, under the most favourable circumstances to its action, is very limited in amount, and may easily be counteracted by a device, which will lessen the acting weight, when a safety-valve is raised. Besides, the proportion which the area of the disk bears to that of the aperture materially affects the amount of this tendency, and is, in practice, very much less than was used in the experiments of M. Clement. The ingenious experiments of M. Hachette and Messrs. Hopkins and Roberts, of Manchester, have shown the truth of these remarks.‖ If,

* The part marked with inverted commas is the conclusion drawn by an able Committee who investigated the cause of this explosion. It is unpleasant to see in this case, how those concerned in the press of steam, were biassed in their views given to the Committee, and communicated, as the Committee testify, as honest convictions, and without intention to deceive. The engine-men were not injured by the explosion. The form of these boilers was no doubt defective, and one part of them will be commented on hereafter. The two boilers exploded almost simultaneously.—Jour. Frank. Inst., vol. xiii. pp. 55 and 126.

† Account of an extraordinary adhesion of the safety-valve of the boiler on board the steam-boat *Legislator*, on the Hudson. By the Engineer. Jour. Frank. Inst., vol. v. p. 355.

‡ Notice in Franklin Journal, vol. iv. p. 97. See also explanations of the phenomenon offered by Jacob Perkins, Esq. in the same volume, p. 252, and in London Jour. Arts, vol. xiii. p. 275. By Dr. Hare in Journ. Frank. Inst. vol. ii. p. 58. By James F. Espys, Esq. in the same vol. p. 59, and by Asa Spencer, Esq in the same vol. p. 61, also remarks on p. 203.

§ In this view the Committee coincide entirely with M Arago. See Annuaire du Bureau des Long. 1830, p. 157, and Jour. Frank. Inst. vol. v. p. 408. In fact, the Committee named in the next note did not sustain the deduction, above referred to in the text, remarking, in very guarded terms, that the limits within which the phenomenon occurs were then not sufficiently known to decide upon the possibility of an accident from it.

‖ M. Hachette, who investigated this subject, shows in a strong point of view the effect of the relative proportions of the disks. When one is not many times the other in size, it is impossible to satisfy the conditions of the problem. Annales de Chim. et de Phys. vol. xxxv. p. 44, &c. The Committee who examined this subject in its relation to the steam-engine, consisting of MM. Biot, Poisson, and Savier, made an experiment in which with a disk, nearly six times the diameter of the opening, and a pressure of steam about 2·8 atmospheres, the tendency to adhesion when the disk was ·01 of an inch from the opening, was but half a pound. Annales de Chim. et de Phys. vol. xxxvi. p. 70. In the experiments of Messrs. Hopkins and Roberts, with an excess of pressure in the effluent air of ·05 of an atmosphere over atmospheric pressure; the total tendency to adhesion at its maximum, was but ·005 of an atmosphere, with an opening of 2¾

however, this action were allowed to have full effect, by dimensions in the valve expressly intended to produce it, an increased area of valve would entirely obviate the objection. Different effective means of lessening the acting weight, on the rise of a safety-valve have been used or proposed, such as that employed by MM. Arago and Dulong* in their experiments, on the elastic force of steam at different temperatures, or the very similar one, described by Mr. L. Hebert in his interesting communication to this Committee.† In them the weight rolls towards the fulcrum when the valve opens.‡ The Committee apprehend that this form, although very effective while in order, would tend by disuse to lose its power of action. They would prefer, in practice, a construction similar to the second form proposed by Mr. Hebert in which the lever being curved effects the same object, while the weight is not required to be moveable. They intend to recommend a suitable form of lever of this kind.

The practice of passing the stem of a safety-valve through a stuffing-box, as it is calculated entirely to defeat the object of the valve, should never be allowed. In fact, the more open to inspection all the parts of the apparatus are the better. If it is necessary to carry off the steam from that which the engine-man has the control of, it can be accomplished without resort to packing.

9. There can be no doubt that the form of the safety-valve materially influences the certainty of its action. Although the disk-valve was early recommended, the nicety of workmanship required to make it tight has limited its use, and perhaps the experiments of M Clement have produced a prejudice against it. The cone, which is in common use, may be more easily tightened when perfectly fitting the seat; but this very fact is an objection to it. No pressure can cause the disk valve to prevent the escape of steam, if the valve and seat be clean, unless they have been ground to fit. The Committee adopted this form of valve in their experiments,§ and in no instance was undue adhesion observed. Throughout their experiments, the pressure of the steam corresponding to the opening of the valve with its different weights, was noted by the steam-gauge, or by the temperature of the water within the boiler. No means were used to keep the valve in other than what might be considered fair working order, but when, from the action of dirt, it had become leaky, the grinding upon the seat was very easily performed, and restored its efficiency. Two valves of the same form were used, and the comparison of the calculated pressures due to the weight upon the valve, with the observed pressures at which the valve rose entirely, or leaked so badly as to require additional weight, uniformly gave the former in excess. The average ratio in the experiments was 1 to 1·035, the former number representing the observed, and the latter the calculated, pressure.

10. These conclusions are sustained, in a general way, by the success which has attended the recommendations of the Select Committee of the British House of Commons. The law, based upon their investigations, requires that there should be two safety-valves upon every boiler, one of which is out of the control of the engineer,—and further provides a penalty for the overloading of either valve, by any person whatever.‖

11. In addition to two safety-valves, the regulations for the safety of the steam-engine in France, require two fusible plates or plugs, of suitable diameter. to be attached to every boiler. These plugs are intended to act by the heat of the enclosed steam, and to give way when it has reached a certain point In the application of them which we are now considering, they are exposed to a pressure corresponding to the temperature, and in order to prevent them from giving way as they verge towards the fusing point, they are covered with wire, or with perforated disks or gratings of metal.

12. This mean of safety was made the subject of elaborate experiments by this Com-

inches, and a disk of six inches in diameter. With a disk of eight inches in diameter, the total tendency was increased from 32 oz. avoirdupois, to 48 oz.; and with disks 4½ inches diameter and under, no such tendency was manifested, the aperture of efflux remaining the same. Manchester Trans. vol. v. N. S. and Jour. Frank. Inst. vol. x. p. 188.

* Annales de Chimie et de Phys. vol. xliii.

† See Replies to Circular of Committee on Explosions, No. XI.

‡ In that of MM. Arago and Dulong there was also an arm projecting on the opposite side of the fulcrum from that on which the weight keeping down the valve was placed; upon this a weight rolled from the fulcrum on opening the valve.

§ Report of Committee on Explosions, Part I. pp. 71, &c. Jour. Frank. Inst. vol. xvii. p. 228.

‖ The regulations relating to the safety-valves of steam-boat boilers, are as follows:—

That every such boiler shall be provided with two sufficient safety-valves, one of which should be inaccessible to the engine-man, and the other accessible to him and to the persons on board the packet.

That the inspector shall examine such safety-valves, and shall certify what is the pressure at which such safety-valves shall open, which pressure shall not exceed one-third of that by which the boiler has been proved, nor one-sixth of that which by calculation it shall be reckoned to sustain.

That a penalty shall be inflicted on any person placing additional weight on either of the safety-valves.

Of twenty three witnesses, practical engineers and others, examined by the Parliamentary Committee, seventeen recommended explicitly the additional safety-valve, out of the control of the engine-man.

mittee.* The result was, that when alloys of tin, lead, and bismuth, such as are used for fusible plates, are exposed to heat and pressure, parts of them soften at temperatures below that at which the entire plate would become liquid. Being exposed to pressure, these fluid parts are forced out,† leaving a less fusible mass. In one case described by the Committee, this operation was carried so far before the plate gave way, that from a plate melting at 254° to 275° Fahr., was produced a mass fusible only at 312° to 345°. One part of the alloy which oozed out was found to melt at 223° and another at 233°.‡ To this action a fusible plug would be also exposed, and the Committee are of opinion that no method of application in which the pressure acts upon these compounds can be efficient in practice.

In the experiments referred to, the plates being thin, were generally burst by pressure; not, however, acting precisely as thin plates of copper or iron would have done, but being partially softened by heat.

13. While the Committee deem it very desirable that a convenient steam-gauge applicable to high-pressure boilers should be devised,§ they consider that until this is done, a substitute should be furnished in a graduated safety-valve, marked with numbers expressing directly in pounds to the square inch the bursting‖ pressure of the steam, and within the control of the engine-man. This would act as a convenient, and, for practice, a sufficiently exact method of knowing what he ought always to be informed of, the bursting pressure in the ordinary working of the boiler. Besides this, however, there should be a lock-up valve, for the original weighting of which there should be a proper responsible agent, and which should be capable of being raised by the engine-man, but not of being kept down. With a valve of this kind of sufficient dimensions, of proper form, and duly weighed, the Committee believe that danger from gradually increasing pressure might be entirely avoided.

A thermometer suitably graduated and passing into the steam or water of the boiler, would prove, under ordinary circumstances, a useful gauge, and may be conveniently applied as described in a subsequent part of this Report.

14. With a view to meet the dangers which have been discussed in this section, the Committee would make the following recommendations, the means of carrying out the principal of which, by law, will be found suggested at the close of the Report:—

First. That every boiler be provided with two safety-valves each of which shall be competent to discharge the steam, made in the ordinary working of the engine. The

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* Report of the Committee on Explosions, of the Franklin Institute, Part I p. 23. "V. Inquiry in relation to plates of fusible alloys." Jour. Frank. Inst. vol. xvii. p. 74.

† This fact, but to a limited extent, seems to have been noticed by M. Gualtier de Claubry, who did not, however, follow out the suggestion. Recueil Industriel, 1829.

‡ The entire series of conclusions from these experiments, which formed one of the most interesting branches of the Committee's investigations, are as follows:—

"The conclusions deduced from the foregoing experiments, on metallic alloys, may be thus stated.

"1st. The impurities of common lead, tin, and bismuth, are usually not such as to affect materially the fusing points of their alloys.

"2d. When mixed in equivalent proportions, tin and lead formed alloys, not presenting the characters of distinct chemical compounds, in definite proportions. The alloys between the range of one equivalent of tin to one of lead, and one equivalent of tin to six of lead, varied considerable in the interval between the temperature of commencing to lose fluidity, and that at which a thermometer, immersed in the solidifying metal, became stationary. These different alloys produced nearly the same stationary temperature in a thermometer plunged into the solidifying metal.

"3d. Fusible metal plates, covered by a perforated metallic disk, and placed upon a steam-boiler, show signs of a fluidity at the disk, before the steam has attained the temperature of fusion of the alloy of which the plate is composed. This fluid metal oozes through the perforations in the disk, and the plate thus loses much of its substance before finally giving vent to the steam.

"4th. The under parts of the plate are not kept from fusion by a protecting film of oxide there formed.

"5th. The thickness of the plate is not important, provided only that it is sufficiently strong to resist the pressure of the steam at temperatures below its point of fusion.

"6th. The temperature at which the plates are cast, and the rate of cooling of the cast metal, do not affect the temperature at which the plates give vent to steam.

"7th. The effect stated in conclusion third, is explained by the nature of the alloys used, which are formed of portions of different fluidities; the more fluid parts are forced out by the pressure of the steam, leaving the less fusible. These latter, in general, are hard, not melted.

"8th. By pressure in a receptacle provided with small openings, this effect of separating the differently fluid portions of an alloy, may be imitated.

"9th. Fusible alloys, used to indicate the temperature of any part of a steam-boiler, should not be exposed to the pressure of the steam, at least not in such a way that the separation of the differently fusible constituents of the alloys may be effected."—Report of Com. on Expl. Part I. p. 34, and Jour. of Frank. Inst. vol. xvii. p. 84.

§ The Committee regret that the hydrostatic safety-valve of Mr. Ewbank has not been brought into use. It would answer, by a slight modification, as a gauge, and no doubt can exist of its being applicable to the stationary engine. The oscillation of the liquid may interfere with its operation on board of steam boats, but to what extent the Committee are not prepared to say. See description and figures, Jour. Frank. Inst. vol. ix. p. 64, and vol. x. p. 2.

‖ This term is used to signify the excess of pressure of the steam within over atmospheric pressure, in contradistinction to the working pressure, which is used to express the total elastic force of the steam.

first of these valves should be graduated by the maker of the engine, and have stamped upon the lever by which it is weighed, the bursting pressure at which it will open, by calculation, when the moveable weight is placed at the several notches. The pressure corresponding to the last notch to be equal to the bursting pressure, under which the engine is to work. The second valve to have a weight fixed immoveably upon it, the pressure of which upon the seat, together with that of the atmosphere upon the valve, is equal to the working pressure of the engine. This valve should be so arranged as to admit of raising, but not of placing additional weight upon it. To this end it should be enclosed. The rise allowed by the inclosure should rather exceed half the radius of the valve-seat.

Second. The Committee recommend to constructors the disk-valve. The diameter of the disk should not exceed once and a half that of the valve-seat, as a less ratio than this will leave sufficient margin, and any sensible tendency to close from the effect of the issuing current will certainly be avoided.

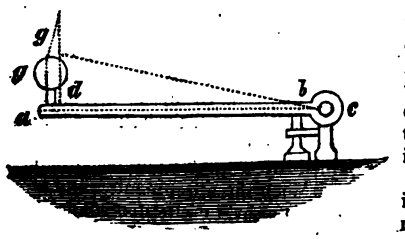
Third. That a cord be attached to the lock-up valve, by which it may be raised at the same time with the free valve. And that the working of each be ascertained at least every two hours.

Fourth. That an open mercury-gauge be provided for each boiler of every engine not carrying more than two atmospheres of working pressure. The height of the mercury to be indicated by a float which shall truly mark upon a graduated scale the bursting pressure in inches.

For high-pressure boilers they recommend the thermometer, graduated to show the pressures corresponding to the temperatures of saturated steam, as a convenient gauge.

Fifth. That the lever of the lock-up valve be bent upwards at the end, so that in rising it shall relieve the valve of part of the weight. A suitable proportion for such relief would be about one-tenth of the pressure derived from the weight, and the height of the bend above the lever should be regulated to meet this.

The lever would have a form similar to the annexed. The part $a\,g$, which is turned up, may be straight or otherwise. The adjustment should be made so that $d\,c$ is nearly nine-tenths of $a\,c$. g being the centre of gravity of the ball, lever, &c. will lie a little out of the centre of the weight, towards the fulcrum.



Sixth. As there can be no doubt that the competition in regard to speed is, or has been, a strong temptation to an undue increase of pressure by engineers or firemen, it should be expressly prohibited by law.

(To be continued.)

ON A DEFINITE RIGHT LINE, APPLICABLE TO PARTICULAR PURPOSES IN ALL COUNTRIES.

Sir,—In reading various literary publications, as they occasionally appear in different countries, much inconvenience does frequently arise from the want of a general scale of measure, which is equally intelligible to all civilised nations. Distances described in one language are difficult of comprehension in another, and are often ascertained with little accuracy by researches of considerable labour. Similar disadvantages, proceeding from the absence of some fixed standard, as a right line, obscure many interesting details of scientific volumes. The altitude of mountains, the breadth of rivers, the dimensions of ancient monuments or of modern edifices, are often imperfectly communicated to our ideas by the most intelligent travellers who write in a foreign language.

No interference with any national scale is proposed as an object of these suggestions; those will all of them remain undisturbed. The purpose now contemplated is the determination of a right line, having a positive longitudinal dimension; and which, as a common scale, may be used in scientific communications, either independently of, or as an explanatory appendage to, any national standard. It may be made to resemble one of two scales upon a map, or upon the first page of a book; and will have as definable a relation to the scales of all countries as to that of any one of them. At present there is no particular scale which is generally understood in different countries, and which can serve to make the standard measure of any one of them intelligible to all the others.

To become useful, the new scale must, in its most limited application, be European; an honour to which it can only

become entitled by being the production of scientific men. The attainment of this object would be most effectively accomplished by the co-operation of a few leading Societies of different states, to whose judgment and accuracy general deference might be implicitly conceded. To those persons who possess a competent knowledge of the subject these ideas are submitted. The writer will not attempt to carry his inquiries to any result beyond the explanations of this paper.

When the sun enters into the vernal equinox, he may be supposed to pass, from the meridianal point, over an arc of a circle containing 45°. The conditions being precisely stated, and remaining perpetually unchanged, his passage over that space at the same annual epoch will be always the same, without any variation; and if the circle be denoted, the chord of the same arc will be always the same without any variation. That right line may be called the solar scale; and it can be verified by a practical scientific experiment.

When the radius of a circle is known, the chord of a given arc becomes known also. These may be determined optionally by scientific men, so that the scale shall have some moderate dimension which may be considered most useful in scientific communications generally. The operations to verify the scale will follow the construction of the instruments to be employed for that purpose. Let two pendulums, alike in all circumstances, be constructed, each having precisely the length of the proposed radius. If these are simultaneously made to vibrate from a position perfectly horizontal, their vibrations will continue to be simultaneous, and will be alike in every respect. But in the proposed experiment, they must be made to vibrate separately. When one pendulum has completed sixty vibrations, the other must be made to repeat and continue the movements with the greatest precision; and the two pendulums must be thus alternately made to pass through sixty similar vibrations each, so that the whole requisite number of vibrations can be summed up at the conclusion of the experiment, with the same exactness (or as nearly so as possible,) as if the movements had been performed by a single pendulum. The operation, which can be thus regulated with two pendulums, can in any number of instances be made by two other pendulums which shall be in all respects the same as the former; and if the operation is conducted in the same point of latitude, the results in every instance ought to be the same without any variation. The duration of the first and of the sixtieth vibration may be alike or unlike, the circumstance will not affect the final result, because the mean duration of all the vibrations, collectively, will be the same in all experiments which are made with the same pendulums under conditions which are all of them precisely the same. The pendulums will move through a definite number of unequal arcs, while the sun moves over one definite arc.

At the fortieth degree of latitude let a small plane surface be prepared with a vertical rod in the centre; and from the middle of that rod as a centre, let there be described a circle, whose radius shall be the length of one of the prepared equal pendulums. Let the meridional point be marked in the circumference of the circle, and a second point be placed distantly from the first, so that it may truly denote an arc of forty-five degrees. As soon as the equinoxial sun enters the meridional point, let the pendulum vibrations commence, and be carefully continued by the two alternating instruments till the sun enters into the point of forty-five degrees. The number of vibrations accomplished ought then to be most accurately recorded. This number of vibrations will denote the length of the pendulum, or the radius of the circle; and as the radius so found in the same place will be always the same, the chord of forty-five degrees, so found, will be the same also. In any subsequent experiments, however multiplied in the same latitude, if the pendulums are taken too long, the given number of vibrations will not be completed during the equinoxial sun's passage from one point to the other of the given arc; and if the pendulums are too short, the number of vibrations will be exceeded at the prescribed completion of the sun's passage. The real length of pendulum, or the real radius of the circle, and also the given chord, can always be truly ascertained by a professional gentleman of high scientific attainments; and no other person ought to attempt so delicate an operation.

When the scale has been satisfactorily verified, it may be divided into one thousand equal subordinate parts; and as the models of the adopted scale can be correctly multiplied, one may be preserved by each of the leading scientific societies of the European kingdoms. If two of the original pendulums could be preserved for ages, they might afford one simple method of ascertaining whether gravity and the earth's diurnal revolution did continue unchangeably the same. The conditions, as to the construction of the pendulums, and as to all other circumstances, are arbitrary and optional in the first instance; but when once prescribed by scientific men, they must be rigorously adhered to afterwards to obtain the true result.

E.

COLLIER'S STEAM-BOILER.

Sir,—I feel much obliged by your noticing my pamphlet, describing the particulars and experiments of my improved steam-boilers, in No. 695 of your valuable and widely-extended work, the *Mechanics' Magazine*, of the 3d inst.; and notwithstanding the severity of your remarks on my invention, I feel grateful to you for affording me an opportunity of explaining that part which you must admit I could not with delicacy have referred to in my pamphlet; and should not have done so now, had I not been publicly attacked. You say, "The public will be surprised to learn (and we wonder Mr. Collier does not inform them how and why it so happened) that the Lords of the Admiralty ordered Mr. Collier's boilers to be removed, and the *Meteor* to be placed out of commission, till she could be refitted with *boilers on the common plan.*"

Now, the facts as narrated in my pamphlet of the successful trials of my boilers till the arrival of the *Meteor* at Falmouth, after having successfully completed her voyage, are indisputable! It was not until after the boilers were removed, and altogether out of my control and superintendence, that an injury was done to them, and in consequence they were reported to their Lordships as unfit for use and past repair, without my being present or being referred to for explanation; this Report their Lordships ordered to be sent to me, and I accordingly inspected the boilers, when I found that a few of the chambers only were in *a trifling degree injured;* a defect that I could have repaired for a few pounds; I remonstrated with their Lordships on the subject, but without effect; they relied on their official reporter, for it was, *I verily believe, pre determined at Woolwich they should be condemned;* and like many others who have had to do with Government reporters, I was obliged to submit, having no means to oppose them. I was, however, *fortunately* enabled to purchase the boilers; I say *fortunately*, because the possession of the boilers gives me now the means of convincing every unprejudiced individual how *unmerited* was the *condemnation.*

I am, sir, one of that body of mechanics whose interests your valuable Magazine is presumed to uphold and protect; my existence depends on my ingenuity and talents, and I therefore claim equally with my fellow-labourers your unbiassed support and protection, if my inventions deserve it. I do not regret the observations you have made, as it enables me to invite and solicit as a favour, that all my brother mechanics and all men of science will inspect my boilers, and see the very trifling defect that caused the Government reporter to condemn my invention—the labour of many anxious hours,—and from which condemnation I have had for some time past to bear up. These *identical boilers* now stand at Globe-stairs Docks, having had the bottoms of the injured chambers repaired, and *are now as sound and as good at this hour as the day they were first placed in the Meteor!* Does not this speak for itself? I have added to these boilers such improvements as my experience suggested, and they are now in a condition to bid defiance to a recurrence of similar injury, either from *accident* or DESIGN. These improvements, you are pleased to say, "are *a little ingeniously arranged complication, and consequent increase of expense.*" Now, with great submission, I beg to state that I consider them *judiciously arranged, and neither complicated nor increasing expense, for not one fraction will be added to the charge for my boilers.* To a discerning and discriminating public, I confidently appeal, and am sanguine enough to believe that it will ultimately awake to its interests, and duly appreciate

the many and important advantages to be found in the use of *these boilers*.

Permit me to correct your error as to the price I received for my boilers *in the "Meteor:"* it was 1500*l.* and not 2000*l.* I was only paid at the same rate as Government paid to their contractors for steam-boilers *on the common plan*.

I confidently rely on your justice in giving this letter a place in your Magazine; and request the favour of your making yourself, by personal inspection, acquainted with their merits, being assured you would not willingly do injustice to the honest labours of a MECHANIC, who is, with the greatest respect,

Your most obedient servant,

E. H. COLLIER.

Globe-stairs Dock, Rotherhithe,
December, 1836.

ON THE ACTION OF THE ATMOSPHERE.

Is not the agitation which takes place in water when it boils, caused by a current of air which enters through the bottom of the vessel, rises up through the water, and thereby causes the bubbling which is called boiling?

And does not the light coloured matter which is called steam consist of small particles, globules, or bubbles, thrown up and carried off from the surface by the air as it rushes through the body of warming or boiling water?

The process through which cold water passes to a boiling state, seems to indicate that the boiling or bubbling is caused by a current of air passing through it. The process commences by the formation of immense numbers of small bubbles on the bottom of the vessel, which gradually enlarge, run into each other, and begin to ascend to the surface of the water, and still they go on increasing in size and number, and in the rapidity of their risings, until they form here and there streams from the bottom of the pan to the surface of the water, and their united action produces the agitation in the water called boiling.

Now these appearances seem to be caused by air, and not by heat, for if a tin vessel containing water be partly immersed in a vessel of boiling water, the water in the tin vessel may be raised to boiling heat, but it will not boil.

From this it seems that the heat is not the cause of the agitation in boiling water, for here is the requisite heat without the boiling; but the air has not access to those parts of the tin vessel which admit the heat; the air is excluded by the boiling water which surrounds them, and hence the reason why the water in the tin vessel does not boil.

The heat of the fire expands the metal of the vessel in which the water boils, and rarefies the air which rushes through the fire, and by these means the air appears to be enabled to penetrate the metal.

If a tumbler or common drinking glass be put into a pan of water sufficiently deep to cover or completely immerse the glass, and then turned upside down, that is, with the mouth to the bottom of the pan, the glass being turned under the water in such a manner that no air can enter it in the act of turning, and that the water may have full possession of the interior of the glass when turned, and the pan then put on the fire to boil, the air will gradually take possession of the glass and drive the water out. The operation of the air under the glass will be plainly perceived by watching the glass.

W.

NOTES AND NOTICES.

Antiquity v. *Novelty*.—The New Islington Cattle Market seems destined to present another illustration of the difficulty with which an old-established trade is removed from its accustomed channels. When the "public-spirited proprietor" had obtained, in spite of the vigorous opposition offered by the City authorities, the Act duly authorising him to open his opposition-shop, it was expected that as soon as he commenced operations, the *old* Smithfield would be deserted, especially as the walls of the metropolis were profusely placarded with declarations purporting to be signed by all the principal graziers in the country, to the effect that they would employ no salesman who did not carry on business exclusively at Islington. Yet what has been the result? Ever since its opening in April, the return of "head of cattle" at Islington has presented a ludicrous contrast with that at Smithfield, and the number has been regularly diminishing even from its original insignificance. At length the degree of comparison seems to have reached the superlative. Monday, December 12th, was the butchers' carnival,—the grand day of preparation for Christmas,—and the following statement shows the "state of the poll" at the rival markets:—

	Beasts.	Sheep.	Calves.	Pigs.
Smithfield . . .	4286	21,150	108	270
Islington . . .	49	1180	None.	None.

On the following Friday, the state of affairs at the New Market was still more dismal:—

	Beasts.	Sheep.	Calves.	Pigs.
Smithfield . . .	1725	3770	180	480
Islington	None!	None!	None!	None!

There was, in fact, no market held,—although if the graziers had been true to their declaration, they must assuredly have had *some* oxen ready to be converted into Christmas beef. Inspirited, it

may be supposed, by their triumph, the Common Council are determined to proceed with vigour in the enlargement of *old* Smithfield. *They* have also had dear-bought experience of the anger of removal in matters of traffic!—the New Farringdon Market having proved so decided a failure, that it is seriously proposed forthwith to convert it into a prison!

Progress of a Delusion.—The South Australian Colonisation scheme is likely, at any rate, to have a fair trial; the Governor and a considerable number of emigrants being now on their way across the ocean, to test the wonder-working effects of a high price of land and low rate of wages on an infant colony. Before setting out they published the first number of a newspaper, of which the second is to appear in the capital of South Australia. The Governor is a Captain Hindmarsh, of the navy, who accepted the appointment after it had been thrown up by Colonel Napier (not the author of the "History of the Peninsular War", on the ground that it would be impossible to found the proposed colony without a military force of at least two hundred men. The Captain is to establish it with no other force than the regulations as to the sale of land will give him. Time will show whether the soldier or the sailor is in the right, and, most probably, prove in all respects such a "tell-tale," as to astonish greatly the projectors of the scheme.

The Charter of the London University has just been made public. It gives to the Fellows the power of conferring degrees, and King's College is considered a part of the University, the Gower-street Institution being for the future to be content with the title of the University College. The Earl of Burlington is the first Chancellor, and Mr. Lubbock, Vice-Chancellor: the list of Fellows includes several distinguished names, with a preponderance, however, of those of the same way of thinking as the founders of the original establishment. The King reserves to himself the powers of Visitor; and the whole proceedings of the Senate appear to be liable to the control of the Secretary of State to such a degree, as to augur ill for the future independence of the new "seat of learning."

The Euphrates Expedition.—It is now understood that Colonel Chesney's expedition is given up as impracticable, and that he is on his return to Europe, after expending a sum *very far* exceeding his estimate before the Parliamentary Committee, without effecting the intended purpose.

City Improvements.—It has sometimes been recommended to carry on a bit-by-bit reform in our streets, instead of making those sweeping alterations which sweep so much money out of the City pocket. But from the account which Goethe gives, in the "Memoirs of his Life," of the effect of an improvement of this kind which was in progress while he lived at Strasburg, in 1769, one would hardly feel inclined to recommend its adoption in any city which can possibly spare the wherewithal to repair and beautify at once. Blondel, an architect of Paris, had furnished the authorities of the town with a plan for amending its ways, by which 140 houses would gain increased space and 80 lose some they already had. The proprietors of these doomed houses were then prohibited from making any repairs to the exterior, and compelled when they rebuilt, which, of course, they were at last necessitated to do, to adopt the prescribed plan, though we do not hear of any compensation being made to those who suffered a loss by it. Of course, those who were entitled to bring their houses further forward were the most ready to rebuild, and accordingly the streets at that time presented a most chaotic appearance, from the number of new-built houses which were seen here and there rushing out "single-handed" into the middle of the street,—while in other parts one might occasionally be detected shrunk back in apparently the most unaccountable manner behind its neighbours. Goethe was not aware at the time he wrote, about forty years after, if the plan yet approached completion; but while he lived there, the strange appearance of the streets was the never-ending subject for the jokes and jeers of the students of Strasburg.

Algerine Mortar.—The mortar used by the ancients in their buildings has always been highly praised as much superior to that of the moderns. Pananti, a recent Italian writer on Algiers, paid a good deal of attention to the subject when residing in Africa, supposing it probable, from the well-known stationary character of Oriental habits, that the ancient method of preparing it might be preserved there, though lost in Europe. He informs us, that the mortar used at Algiers is made of two parts wood-ashes, three parts lime, and one part sand—to this composition they give the name *Tabbi*. After mixing these ingredients together, they throw in a quantity of *oil*, and beat the whole together for three days and nights without intermission; by which time it has attained the proper consistence. After being used in building, it becomes harder than marble, is impermeable to water, and resists the operation of Time and the elements.

Completion of the Great Viaduct on the Grand Junction Railway.—On Friday, Dec. 9, the ceremony of keying the last arch of this great structure took place. A party of the Directors from Liverpool attended for the purpose of witnessing the completion of this work, and were met by Mr. Locke, the engineer, and the resident engineers and contractors on the line.—At two o'clock the trowel was presented to Mr. Heyworth, as the senior Director present, who, after placing the last stone in its bed, addressed the party present. Excellent speeches were afterwards delivered by Mr. Locke, the engineer, and the Rev. W. Stanhope, who spoke highly of the general good conduct of the workmen and all employed. In the evening the viaduct was illuminated with torches, and fireworks were displayed in great abundance, during which time the workmen were regaled with a good dinner and excellent cheer.—*Staffordshire Advertiser.*

The Supplement to Vol. XXV., containing Title, Table of Contents, Index, and Plate of Specimens of English Medallic Engraving by Mr. Bate, was published on the 1st of December, price 6d.

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HUTCHISON'S PATENT GAS-CONDENSER.

Fig. 1.

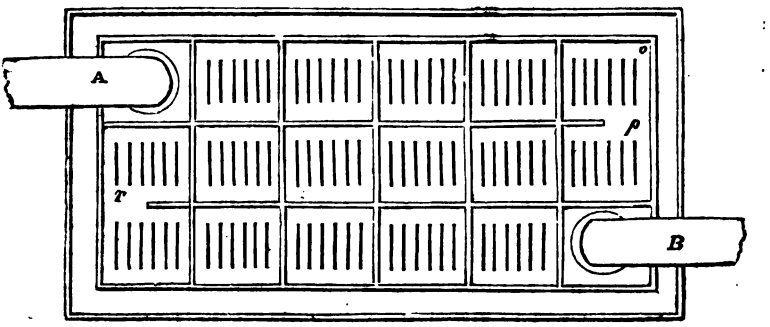
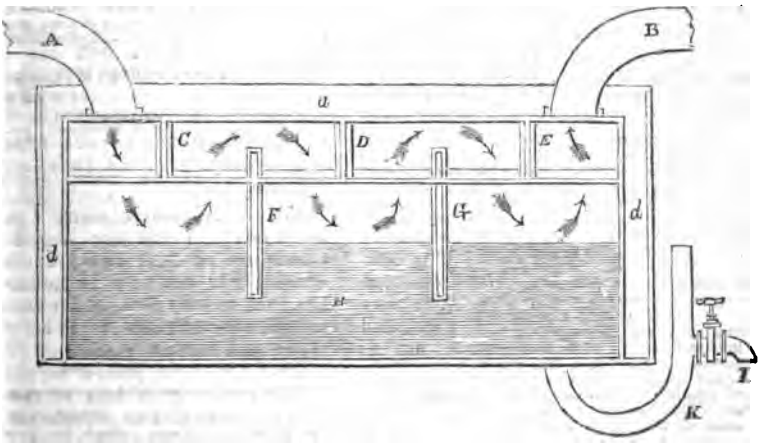


Fig. 2.



HUTCHISON'S PATENT GAS-CONDENSER.

Sir,—The generating of gas for the purpose of affording light has now become necessary to the comfort and convenience of man. And as, in connexion with chemistry, it has courted the investigation of men of the first rank in that science, it has followed as a consequence that great and important improvements in its manufacture have taken place, and are coming into daily operation, tending not only to render the flame more brilliant in light and less offensive in smell, but to cheapen it considerably to the consumer.

Gas, when first obtained from the carbonised coal, requires considerable care and trouble in preparing it for consumption; it leaves the retort in a highly heated and rarefied state, accompanied with tar-oil and water, and other gases, some of them highly prejudicial to health, as well as producing a very indifferent light. In this state it is nearly unfit for use, and has to undergo several chemical processes ere it yields that effulgent light so justly admired: it has to be cooled or condensed, and some of its grosser impurities withdrawn, and for this purpose it is conveyed into the condenser, where, as it cools, it deposits the weightier particles, which, while heated, amalgamate with the gas itself; hence it follows, that the more it could be divided and cooled, the purer and lighter the gas would be obtained. The following is a description of the accompanying drawing of a condenser in use at the London Gas-Works, Vauxhall, invented by Mr. Stephen Hutchison.

Fig. 1 represents the condenser with the cover off, showing the perforated plates, an ingenious contrivance, by means of which the gas is completely divided and condensed before it is conducted into the purifier. Having entered the condenser at the pipe A, it rises through the first perforated plate, and passing over the division F, fig. 2, becomes further divided as it sinks through the second, and so on, alternately, as it rises and falls, until it reaches the fifth division or plate at O, when it is compelled to retrograde and traverse a second range of perforated plates in like manner as the first, entering at P, and continuing its course until it rises again at *r*, and so enters the third division, and finally leaves the condenser at the exit pipe B, having been divided and subdivided sixteen times; by which operation not one particle of the gas leaves the condenser in its primitive state.

Previous to the above invention the gas was usually forced through upright pipes placed in a tank of water, ascending and descending until it reached the exit-pipe; and, as a consequence, only a small portion (the exterior of the column) of the gas was condensed, the rest passing out of the condenser much in the same state that it entered; hence its impurities.

a a a, fig. 2, is a tank filled with water, surrounding the condenser, which cools the gas; A, the main or pipe by which it enters B, the exit-pipe; C D E F G, upright plates, under and over which the gas traverses, passing alternately through the perforated plates, as already described; H, the water in which the tar, &c. is deposited, and which is drawn off by the cock I attached to the hydraulic-pipe K. The arrows show the course of the gas as it sinks and rises.

The above happy arrangement was included in the patent of the London Gas Company, and tried by them at first on a small scale; when having been found to answer the utmost expectations of the engineer, they have since erected others of greater magnitude in accordance with their increasing contracts for gas.

I am, Sir,
Your obedient servant,
ENSOR.

FURTHER REMARKS ON THE REPORT OF THE COMMITTEE ON ARTS AND MANUFACTURES.

Sir,—There are so many "points of imbecility" in the late Report of the Committee on Arts and Manufactures, which I had not room to notice in my last, but which call most loudly for the severest animadversion, that I am tempted to crave a further portion of your columns for the resumption of my strictures.

The anti-English bias of the Committee may be said to pervade every line of the Report. To such an extent, indeed, is the system of puffing all the performances of foreigners carried in its pages; that, although it professes to treat of the best means of extending a knowledge of art among our own population, by far the greater portion of its space is

devoted to the department of "foreign affairs." It might certainly be necessary for the Committee, in the course of their labours, to allude to the means of extending art in practice on the Continent; but it was quite as certainly *not* necessary, while complaining of want of room to discuss more legitimate topics, to "travel out of the records" with such valuable scraps of information; and, withal, so *foreign* to the purpose, as, that Kunst-Vereine, or picture-lotteries, "appear to have been introduced into Prussia by M. Von Humboldt." This may be very true, but pray what bearing has such a fact on the matter in hand? M. Von Humboldt may have "deserved well of his country" by his lottery-promoting exertions, but what, in the name of wonder, has the fact of *his* having introduced Kunst-Vereine "into Prussia" got to do with the extension of a knowledge of the arts of design among the manufacturing population of Great Britain? What would the Committee themselves think of a bevy of German senators, charged with a similar inquiry, *mutatis mutandis*, to their own, who should overload their Report, not only with the interesting information that "some years ago there was a picture-lottery in England," but with the still more intensely interesting fact, that "the name of the projector of this English lottery was Tomkins." All this would be true, quite true; but, after all, what possible connexion would it have with the state of German art?

To tell the truth, our worthy Committee thus lugged in poor Humboldt by the head and shoulders, merely to gratify their unhappy propensity to mention as many foreign names as possible. Dr. Waagen and the Baron Von Klenze are brought in at every turn;—if the policy of continuing the Royal Academy is to be considered, the authority of "M. Horace Vernet" is adduced to settle the question; and, worse than all, while not a single word can be spared to commemorate any of the proofs of British ingenuity which came before them, the Committee devote a whole paragraph to record the evidence of a "M. Guillotte," as to the superiority of French silk-weaving, and another to a particular notice of the exertions of "M. Ternaux," and "M. Couder," to introduce the manufacture of the Cashmere shawls *into France!* Strange matter this for an English Report.

In my former letter I brought forward a few facts rather opposed to the latter part of the sweeping conclusion of the Committee, that we are terribly behindhand in art, "from the highest branches of poetical design, down to the lowest connexion between design and manufacture;" and now, to invalidate the first count of the indictment altogether, it will be only necessary to quote their own words. Inconsistent, indeed, their Report may well be called, when we have only to look forward a few lines from the lamentation over the state of the "highest branches of poetical design," to find the information that "in England a wealthy manufacturer has *no difficulty* in procuring *superior designs*" (!) that "our affluent silversmiths have called to their aid the genius of Flaxman and of Stothard" (no foreigners, be it observed), and that it is only "the manufacturer of *cheap* plate and *inferior* jewellery," who cannot compete with his French rivals! Had the Committee forgotten their wholesale denunciation when they allowed these facts to creep in? If not, why, for the sake of their own consistency, did they not expunge either their denunciation, or the facts which give it the lie? Had they perceived their dilemma, their foreign instinct would doubtless have led them to get rid of *the latter* in preference!

M. Guillotte's evidence, already alluded to, supplies an amusing instance of the French talent for setting things in the best possible light for the purpose in view. He tells the Committee (and the Committee think the tale worthy of a place for itself in their Report,) that "a French capitalist employs three or four artists, where in England one artist would supply eight or ten manufacturers." Surprising, certainly, but quite true! "This is exemplified in the process called by the French the '*mise en carte*.' It appears that in England the designer of the pattern and the person who applies it to the manufacture, are distinct persons. In France *the workman is himself the artist.*" This ingenious explanation of the mystery puts one in mind of the Welchman who boasted of the feast given by his father, in which no less than twenty cooks were employed; i. e. *every man toasted his own cheese!* The Welchman lost his importance when he was

obliged to let out the truth; but our Frenchman, more fortunate in the simplicity of his audience, retains his in all its freshness to the last. Yet the Committee had been lectured* on the effects of the "division of labour" principle in this very matter of design; and, perhaps, even the writer of the Report himself could comprehend how a Stothard or a Flaxman might be more of an artist than the generality of journeyman silversmiths. The worthy Welchman's brag serves to suggest one of the ways in which the Committee may have received that overpowering impression of the thoroughly-universal diffusion of "art" among our lively neighbours, which shows itself in every line of their Report. In the course of their elaborate inquiries, they may have discovered that every inn and every café in "*la belle France*" can boast of its "*artiste*," although they may not have been scrutinising enough to elicit the fact that he flourishes in the person of (in plain English,) the cook; and that his knowledge of drawing extends no further than the drawing of a fowl! "Art" must needs be pretty universally diffused where not only every silk-weaver, but every cook and every barber in the nation ranks himself as an "artist" *ex-officio*.

The "extreme accessibility" of museums and galleries on the Continent has often been dwelt upon before the Committee joined in the cry. Yet it may be doubted, after all, whether this "accessibility" is so "extreme" as is generally taken for granted. Visitors in such cases are usually deceived by the practice of throwing open the doors as widely as possible to all foreigners; a practice partly adopted for the purposes of deception. A foreigner, with his passport in his hand, is always a privileged person; regulations and restrictions are forgotten and laid aside at his approach; and the result is, that he returns home with an idea that access to the treasures of art and science abroad is as "free as air" to all the world. They who are "native, and to the manner born," know the difference. A few hours, on one or perhaps two days in the week, is all the time allowed to *them* to snatch a glimpse at the collections, whose splendour is reserved for the dazzling of foreign eyes throughout the rest of the week. Our National Gallery will, at least, possess a superiority over that of Paris, in one respect; although the exhibition of the Royal Academy is to be under the same roof, it is not proposed to shut out the view of the best works of the old masters for a considerable portion of the year by *hanging the productions of their living successors in front of them*—as is the practice at the Louvre, the very head-quarters of taste! As it *is* the practice there, it is a wonder its adoption here was not recommended by the Committee!

Not that they always recommend a servile copy of Continental practices; if they did, they would not insist that our proposed gratuitous public exhibitions should be "accessible after working-hours," for that is not the way they manage these matters in France. If I recollect rightly, the hours are usually from ten to two, or some part of the middle of the day not especially convenient to the working-classes, whose chief opportunities must occur on that universally open day, Sunday, a day usually devoted in England to other objects than visiting the picture-gallery and the theatre. How the Committee could contrive to drag a notice of the "vexatious fees" demanded at Westminster Abbey, St. Paul's, and other public buildings, into such a Report as theirs professes to be, it would not be easy to conceive before seeing the feat performed. *Then* nothing seems more obvious than the reflection, that, as there is no "principle of cohesion" in the whole Report, and each paragraph has just as much connexion with its neighbour, or with the main subject itself, as mere accident may give it—it need excite no wonder to find Marylebone Workhouse or the Millbank Penitentiary figuring away in its pages, much less St. Paul's and Westminster Abbey. And even here the Committee continue to display their genius for blundering! They remark, "in the Abbey of Westminster not only is a fee demanded at the doors, but supplementary fees are extorted in different portions of the building:" leaving it to be inferred that the clerical showmen of St. Paul's satisfy themselves with the twopence at the door—a very serious mistake, as they would find by paying a visit to the whispering-gallery, the great bell, or any other of the "curiosities!" The system of "extort-

* Vide the evidence of Mr. J. C. Robertson.

ing fees," perhaps, is more universal than the Committee dream of. Are they quite sure, for instance, that it is not in full vigour at *St. Genevieve and Notre Dame de Paris?* Let them endeavour to get a view from either, of the capitals where "extreme accessibility" is the order of the day, and they will obtain some enlightenment on the matter. Although not unheard-of in France, however, the custom is a bad one. The "wax-work" may be "well worth seeing," and the Dean of Westminster may be quite as "respectable" an individual as he is always averred to be when the fee-taking system is objected to; but it would undoubtedly be "creditable to the nation" if the wax-work were sent packing at once, and the Abbey thrown open to the public, even if the measure involved the necessity of making good the losses of the very respectable show-shopkeeping Dean from some other source. The denunciation of the Committee is not bad in itself, but sadly out of place.

The same character attaches to another paragraph, which calls for remark. It is stated, on the high authority of Baron von Klenze (*ecce iterum Crispinus!*) "that the influence of Professor Beuth's publications is already perceptible in the shops and dwelling-houses at Berlin." If not, why not? Why is our attention so particularly called to improvements in the shops of the Prussian metropolis? Have those of our own remained stationary? Do the Committee wish to insinuate, that deprived as English artisans have been of the advantage of consulting those often referred to productions of Professor Beuth, our shopkeepers have been obliged to drudge on as they best might in their old habitations, and content themselves with the vain wish that they could emulate the surpassing splendours of Berlin? It should seem even so. In vain has Everington laid out his thousands on all that gilding and plate-glass could do to dazzle all beholders—in vain have Hitchcock and Rogers amazed, indeed, the very faculties of eyes with their acre of shop-front and their Brobdignag windows—in vain does every street present its gin-shop, all architectural front without and all elaborate carving within—the Committee see only with the eyes of Baron von Klenze, and lament that the spirit of improvement can be looked for only in Germany? Well, indeed, may they disregard these individual attempts, when they deign not to take the slightest notice of—what some would call—*wholesale* improvements at home; such, for instance, as the erection of the matchless range of palace-shops in Regent-street, or the still more recent grand building operation in the very centre of the city — not of Berlin — but London!

I remain, Sir,
Yours most respectfully,
H.

Dec. 20, 1836.

ARTIFICIAL ELECTRIC LIGHTNING.

Sir,—It is well known that a very perfect representation of lightning is obtained by taking strong sparks from a powerful electrical-machine, or by passing them over leather covered with metallic leaves, &c. But in all these methods it has been found impossible to pass the spark any considerable distance, a few inches being the utmost to which it has been sent. By pursuing the following method, I have sent the *shock* from a jar containing 91 square inches, *when only half charged*, through 6¼ feet, the whole line being luminous; generally speaking, without colour, excepting the usual one of the spark. A frame of wood (rounded, and having balls at the corners) 7¼ feet long, and 12 inches inside, was made and covered with black silk, and a narrow, zig-zag stripe was run along the middle of it, with a thick varnish made by dissolving resin in spirit of turpentine. Upon this narrow line brass filings were dusted through a sieve, so as entirely to hide the varnish. When perfectly dry, the loose filings were brushed off with a hard brush, and if any part was not luminous, then that part was re-brushed so as to remove a few of the filings. In the first attempt the stripe was 1½ inch wide; but not answering well, it was taken off and one only half an inch put on. I believe it would pass the shock further, and with greater facility, if decreased to half that quantity.

It is remarkable, that when the discharging-rod is held upon the conductor, and the wire is fastened to the end of the stripe of brass filings, there is not only a continued line of fire, but every half dozen turns of the cylinder an actual discharge occurs from the jar. Does this

not show how the discharges happen amongst the clouds? Namely, by the accumulation increasing faster than the discharge, through imperfect conductors, whereby the increase in a certain time becomes sufficient to leap the interruptions. I have constructed another frame, 5 feet square, and covered it with silk. The middle part of it for about 3¼ feet square is covered with brass filings for the purpose of showing how the "sheet-lightning" is produced, for I consider it to be the actual light of the electricity generally, if not always, and not the reflection from the clouds.

I am, Sir, yours, &c.

W. ETTRICK.

High Barns, Sunderland, Dec. 19, 1836.

REPORT OF THE COMMITTEE OF THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS, ON THE EXPLOSIONS OF STEAM-BOILERS. PART II., CONTAINING THE GENERAL REPORT OF THE COMMITTEE.

(From the *Journal of the Franklin Institute.*)

(Continued from p. 236.)

II. Explosions produced by the presence of unduly heated metal within a steam-boiler.

15. In a properly constructed steam-boiler no part of the metal is exposed to the direct action of the fire, without being immediately in contact with water: the temperature of the metal cannot be raised above that of the water, and is thus determined by the weight upon the safety valve. When, from any cause, the metal is not so circumstanced, it becomes unduly heated, and danger may arise from two sources; first, the metal is weakened and rendered less capable of resisting even ordinary pressure; second, it serves as a reservoir of heat ready to bring into existence highly elastic steam, whenever water shall obtain access to it.

16. The first of these positions rests upon the basis of direct experiment, and is, the Committee believe, generally admitted.* Their experiments on the strength of materials have, however, developed a curious fact in regard to the strength of malleable iron, namely, that it slowly increases at first with an increase of temperature, and attains its maximum at a temperature above that at which any of the steam-engines used in practice, are worked. Above this maximum, the decrease of strength is very rapid; so as to be, at a red heat, but about one-sixth of that at ordinary temperatures. Copper, on the contrary, is weakened by any increase of temperature above the lowest, which was tried, namely, 32° Fahr. The fact just stated in regard to iron, is interesting in its application to the proof of iron boilers, by the water-press, and as shewing the great, and rapidly increasing, danger from diminished strength, as the metal is raised above the temperature of maximum strength.

17. Secondly, the heated metal serves as a reservoir of heat to furnish highly elastic steam, when water is in any way brought into contact with it. That highly heated metal can produce steam rapidly, has hitherto been a controverted position. In the experiments of Klaproth, successive drops of water thrown into an iron spoon, originally heated to redness, vaporised the more rapidly as the metal lost heat. In the experiments of Perkins and others, larger quantities of water in highly heated metallic vessels, vaporised very slowly. It is true that by injecting water into an iron cylinder, heated to redness, Mr. Perkins found a sudden increase of elasticity; but he attributed the effect to the hot and unsaturated steam which the cylinder contained, and through which the ejected water passed.† The Committee found that the temperature of clean iron at which it vaporised drops of water most rapidly, was 334° Fahr.‡ The developement of a repulsive force is so rapid above this temperature, that drops which required but one second to disappear, at the temperature of maximum vaporisation, required 152 seconds when the metal was heated to 396°. One-eighth of an ounce of water introduced into an iron bowl, three-sixteenths of an inch thick, and supplied with heat by an oil-bath, at the temperature of 546° Fahr., was vaporised in fifteen seconds, while at the initial temperature of 507° Fahr., that of most rapid vaporisation under these circumstances, it disappeared in thirteen seconds. The cooling effect of the water upon the metal is here strikingly shown, by the increased temperature to which the latter has to be raised at the beginning of the experiment, in order to give the most rapid vaporisation. A further illustration of the same kind is afforded by comparing the temperature giving most rapid vaporisation, when the metal of the bowl is supplied with heat by a good and a bad conductor, or imperfect circulator, as

* In the Minutes of the Select Committee of the House of Commons there is a statement by Mr. John Steel that cast-iron is strongest at the temperature of 300°, but it is not supported by reference to experiment.

† Franklin Journal, vol. iii. p. 418. Lond. Mechs. Mag. or Jour. Frank. Inst. vol. ix. p. 348.

‡ Report of Com. on Explosions, Part I. "Vaporisation of drops." Reply to Query VI. Jour. Frank. Inst. vol. xvii. p. 90.

by a bath of tin and one of oil. With a rough surface, an iron bowl one-quarter of an inch thick, vaporised one-eighth of an ounce of water most rapidly by introducing it when the metal was at 555° Fahr., the bowl being in an oil-bath; while in a tin bath the corresponding temperature was 508° Fahr.

18. By carrying out this idea we have the clue to the action of water thrown, in considerable quantities, upon heated metal; and find, accordingly, that when the water was increased sixteen times, or from one-eighth of an ounce to two ounces, the temperature of most rapid vaporisation was raised from 460° to 600° Fah.; the surface of the metal being smooth, and the heat supplied through tin. Now, although differences in the mode of applying heat will alter these temperatures, it is clear that they rise rapidly with the quantity of water thrown upon the metal. In the case where as much water was thrown into an iron bowl as it could contain without loss by ebullition, the temperature of greatest vaporisation, upon a clean surface, was 600° Fah., or about 200° below a red heat, and would, according to analogy, have been higher if on a rough, or oxidated, surface *

19. These observations explain the direct experiments made by the Committee, in which highly elastic steam was always rapidly produced by injecting water into a boiler heated to bright redness.† In one case, by the injection of ten ounces of water the elasticity of the steam was raised, in less than two minutes, to upwards of twelve atmospheres, and a miniature explosion produced. The remarks made in this experiment show, that, wherever the water slid along the bottom of the boiler, the spot of contact was for the instant blackened, by the sudden reduction of temperature, and this under the unfavourable circumstance of the introduction of a limited quantity. The bottom of the boiler in these experiments was clean, but not bright. The time required for the generation of explosive steam under these circumstances does not yet admit of calculation, but this may be affirmed with certainty, that a safety-valve which, under ordinary circumstances, may be adequate to carry off the excess of steam produced in a boiler, will prove wholly insufficient for its escape, in the supposed case.

20. These experiments are entirely supported by well-authenticated cases of explosions in steam-boat boilers. Mr. Bakewell‡ gives an instance, in the case of the steam-boat *Grampus*, where six cylindrical boilers, each 38 inches in diameter, exploded simultaneously. The engineer had discovered that they contained very little water, and had suddenly thrown in a plentiful supply. When one of the boilers of the steam-boat *Car of Commerce*§ exploded, it was well known that the pumps had not furnished the requisite supply of water; and just after an attempt to remedy this difficulty, the head of one of the boilers was thrown off. This boiler was, it seems, differently constructed from the others, with which it was connected, and which did not give way.

The first of these cases is distinctly made out, and the second cannot be resolved into a matter of opinion, as may perhaps be done with other accidents, which, though there is a strong probability that they are to be traced to this cause, the Committee refrain from quoting.

21. It is, of course, not assumed that an explosion must necessarily follow the presence of heated metal; for other circumstances must conspire to produce such a result. Facts, indeed, may be brought to show that, in certain cases, these attendant circumstances have been accidentally wanting, or have been judiciously avoided.

As examples of this, may be taken instances mentioned by Col. Long‖, in which timber on the top of cylindrical boilers has been known to take fire, though considerably remote from any fire-flue. Those to which Mr. Bakewell¶ has been an eye-witness, when the steam has been so highly heated after leaving the boiler, as still to burn the hempen packing of the steam-cylinder, and where wood contiguous to the boiler has been fired. Similar incidents not followed by explosions have occurred in the mines of Cornwall,** and in one of the Liverpool and Dublin packets.†† Examples of the second kind will be referred to subsequently.

22. With such a powerful agent present, as the highly elastic steam which it has been proved may be rapidly generated by the heated metal, it might have been supposed

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* Report of Com. on Expl. &c. Reply to Query IV. "Vaporisation of increased quantities of water." Jour. Frank. Inst. vol. xvii. p. 169.

† Ibid. Reply to Query II.

‡ Letter to Secretary of Treasury, communicated to Com. on Expl. Reply to Circular of Com. No. XII. Also, Letter of Thos. J. Haldermann, No. XXI. of Replies.

§ Letter of Thos. J. Haldermann, No. XXI. of Replies to Circular, &c.

‖ Replies to Circular, &c. No. II.

¶ Replies, &c. No. XII.

** Mr. Perkins states, on the authority of Mr. Moyle, that a ladder accidentally resting upon the top of a boiler, was set on fire by heat communicated from thence. Franklin Jour. vol. iii. p. 417, or Lond. Jour. Arts, vol. xiii. p. 95.

†† Evidence before Com. of House of Commons, 1817. Hazard on Explosions. Frank. Jour. vol. iii. Ewbank on Explosions. Jour. Frank. Inst. vol. x.

that no other cause for explosion would have been looked for, than the action of this steam. The case is, however, otherwise, and the Committee must turn aside from their direct course to examine briefly the theory which assigns the production, and subsequent destruction, of hydrogen gas, as the cause of the explosion. According to this view, the water thrown upon the metal is decomposed, and hydrogen gas evolved; or a similar decomposition of the steam, by the hot metal, takes place. This hydrogen, becoming mixed with oxygen, is ignited by the red-hot metal, and an explosion ensues. The difficulty of furnishing oxygen for the hydrogen to combine with, has lately been met more satisfactorily by Mr. Perkins, than it had been by any preceding theorists. He asserts that air is frequently drawn in by the operation of the forcing-pump, and is thus accumulated in the boiler. The primary hypothesis, in regard to the production of hydrogen, having been fully disproved by the experiments of this Committee, there is no necessity for examining the minor ones; it may be well, however, to observe, that if air were introduced into a highly heated boiler, containing hydrogen in too large a quantity either to combine explosively, or silently, with the oxygen of the air, that element would be taken up by the heated metal; and that gases cannot enter, and remain without mixing with the steam, and being carried out with it. In the experiments of the Committee, which have been referred to,* water was thrown upon the bottom of a boiler, heated to orange redness, without being decomposed. In fact the scale of oxide existing upon the bottom, prevented the decomposition of water, by enfeebling the affinity which would produce it. This boiler was carefully cleaned, and in good working condition; a condition in which no one need be told, a boiler has not a bright metallic surface.

23. Carburetted hydrogen does no doubt exist at times in a boiler, in greater or less quantities, from the decomposition of oil, or of vegetable substances introduced to stop leaks, or to prevent deposits, but nothing warrants the idea that it can accumulate and mix with air, so as to be dangerous.

In furnaces where coal is used as a fuel, it will be seen in the sequel that gas, if prevented from escaping by the closing of a damper, may collect, and may possibly be a source of danger.† The ignition of a mixture of coal-gas and air in a furnace has been known to destroy it,‡ as also of a mixture of gas from resinous wood and air; but these are cases altogether foreign from the subject under discussion.§

24. The explosion of the steam-boat *Enterprise*, on the Savannah river, is said to have occurred at the instant the boat was struck by lightning. This has been advanced as confirming the hydrogen hypothesis; but no inference can fairly be drawn from an accident, in regard to which the circumstances are so little known. If there was hydrogen present, there must have been unduly heated metal, and the direct action of electricity on the non-conductors around the boiler, may have so displaced it as to bring water upon the heated metal, and thus to effect an explosion. This, like the other supposition, is mere hypothesis. It is certainly, however, quite as contrary to analogy, that an electric spark should pass through any part of a space, like the interior of a boiler surrounded by a conductor, and thus explode a mixture of hydrogen and oxygen within it, as that it should shatter this extensive conductor by its direct action. The Committee consider the circumstances of this case as too ill-defined to draw any inference from it, certainly not one which is contrary to sound theory, by which they mean general induction from numerous well-observed facts.

25. Another case has been urged with much more appearance of directness in the testimony. A boiler in the Union rolling-mills, at Pittsburgh, burst with a tremendous explosion; a cylinder with one of the heads attached was thrown out of the works, and rising to a considerable height in the air, fell nearly 200 yards from its former bed. A passenger in a boat which was near at the time, describes a stream of fire, as issuing from behind the boiler, which, according to the hypothesis under discussion, was a stream of burning hydrogen. It is almost needless to remark, that if hydrogen had been the

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* The reader should refer to these, that he may see the care which was taken in them. A negative result requires so much more caution than a positive one, that more time was devoted to those experiments in order to make them satisfactory, than the Committee deemed warranted by the importance of the subject. Report of Com. on Explosions, Part I. p. 61, &c. Jour. Frank. Inst. vol. xvii. p. 217.

† Explosion in the Gold mines as given by John Taylor. Esq. Philos. Mag. vol. i.

‡ M. Arago states this to be the fact, on the authority of M. Gay Lussac. A furnace was thus destroyed at the Paris arsenal. Annuaire du Bureau des Long. 1830, p. 197, and Jour. Frank. Inst. vol. vi. p. 54.

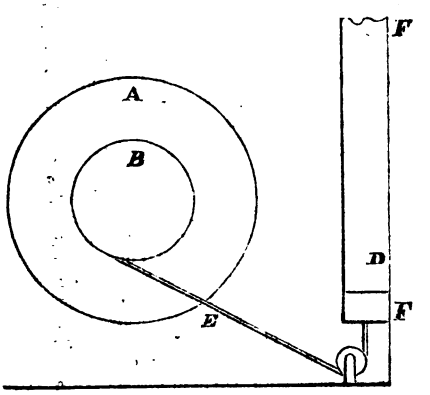
§ See the case of an explosion of a sheet-iron drum attached to an anthracite-stove, with its explanation by Prof. Hare. Jour. Frank. Inst. vol. vi. p. 337. Pine shavings were used to kindle the fire, the gas from which, mixing with the air in the pipes and drum, produced an explosion, when the flame from the kindled shavings rose into it. Refer also to the explosion of the bellows of a smith's forge. Silliman's Jour. vol. xxiv. p. 192.

cause of the explosion, it would not have burned in a stream behind the empty boiler as it rose; the observation is, however, perfectly well explained by Dr. Jones,* by the stream of light which appears to attend every luminous substance moving rapidly, on account of the duration of the impression upon the eye. That the boiler was red-hot, there appears no doubt.

26. From this digression the Committee return to the pursuit of their subject. They conceive that it has been fully established, that the presence of unduly heated metal is dangerous, both from the weakness of the material, and the possibility of its producing highly elastic steam. They, therefore, proceed to examine the probable causes leading to this result, and which have been suggested either in the communications made to them or in other documents, and the proposed remedies for, or precautions against, the danger.

(To be continued.)

PNEUMATIC WATCH MAINSPRING.



Sir,—Allow me, through the medium of your Magazine, to call the attention of mechanics to the pressure of the atmosphere, as a substitute for mainsprings in table-clocks. Its application to a clock as a motive-force may be easily understood by a reference to the above diagram:—A represents the great wheel; B the cylinder on which the cat-gut, E, is wound; this string is connected with the piston D at F; the tube F F is to be closed at top in such a manner, that when the string is wound up, the descent of the piston may produce a vacuum. The pressure of the air on the piston will set the wheels in motion.

I am, &c.

THOS. A. OLLIVIER.

Jersey, Nov. 5, 1836.

* Jour. Frank. Inst. vol. iii. pp. 70, 71. "Editor on Explosions in Steam-Boilers."

CASE IN TURNING.

Sir,—Having occasion to fit a foot-wheel to a mandril with three groves, I find considerable difficulty in ascertaining what the relative circumferences of the three groves on the foot-wheel must be, to enable the same band to fit the corresponding circles on both. Not being much of a mathematician, I have, after a few unsuccessful attempts to find a rule applicable to the case, given up the calculation in despair, and unless some one of your talented correspondents will assist me, I shall be obliged to have recourse to diagrams, and constructing circle after circle on the foot-wheel, by actual measurement ascertain when they approach the proper size. I have no doubt that by this means a result may be found near enough for most practical purposes; but it will be a most tedious and unsatisfactory way of arriving at it, and when found will be only applicable to this one particular case. I have stated my difficulty to several practical men, and they have acknowledged they are unacquainted with any rule which can assist me, and that they have themselves been similarly inconvenienced from the want of one. If, therefore, any of your readers can favour me with a solution of the following question, and any rule which is applicable to such cases generally, you will enlighten several of your readers and very much oblige,

I am, Sir,

Your constant subscriber,

H. F. H.

Question.—Suppose a mandril-wheel has three groves, the diameter of the largest being 8 inches, of the second 5½ inches, and of the smallest 3 inches. A band passes round the smallest circle on the mandril, and round the largest circle of a foot-wheel, which circle is 26 inches in diameter, of what diameter must the other two circles on the foot-wheel be, to correspond with the other two

circles on the mandril, so as to enable the same band to fit them equally well; the centre of the mandril being fixed 30 inches above the centre of the foot-wheel?

DURABILITY OF WOOD.

(From the *Genesee Farmer.*)

The subject of the durability of different kinds of wood when exposed to the action of air and moisture, though one of great importance to the farmer, and the public at large, does not seem to have received that degree of attention and elucidation it deserves. The Teak tree (*Tectona Grandis*) of the East Indies, and the Live Oak (*Quercus virens*) of our southern forests, appear to be nearly indestructable when employed as timber, and in naval architecture. But these from their natures cannot be cultivated in the northern States, and we must seek in our forests trees which shall approach or rival the above in excellence and durability. Fortunately these qualities are found nearly in perfection in the Yellow Locust (*Robinia pseudacacia*), and the Red Cedar (*Juniperus virgininaa*), and in a lesser degree in many others; a knowledge of the comparative durability of which, properly ascertained, would be of essential service to the public.

Thirty-two years since, in enclosing some newly cleared field, we had occasion to set some bar posts, and, at a point where four fields cornered, we placed one so that it served for four pair of bars, one to each field. The post was the common white cedar (*Cupressus thuyoides*), cut from a thrifty tree fourteen inches in diameter, the holes on the four sides cut in the usual manner with a narrow axe, the bark stripped from the whole, and the large end set two feet in the earth, which at that place was rather moist. After standing more than twenty years, or until the basswood fences with which it was connected had rotted down, it was removed to another position, where it has since served for two pair of bars and one gate. At the time of removal it appeared quite sound, and present appearances indicate a duration of another twenty years at least. From our experiments we are convinced that large posts are far more durable than small ones, and that those which occupy the whole diameter of the tree, are better than sawed or quartered trees of equal size.

In the *Railroad Journal*, in an article on the advantages of lime, as a preservation of timber, the following instance of its effect on the dursbility of the white pine (*Pinus abies*), is given:—The planks were a parcel of pine planks used as platform on the ground, on which to make live mortar.—This platform was laid by the informant's grandfather in a corner of the yard, and used every year more or less for the purpose of a mortar bed. His father continued it in the same use; himself, the grandson, continued it for a time, as long as he had occasion, after which it lay some years unused, and overgrown with grass and weeds. At length, wanting the ground for another purpose, he had it torn up and removed, expecting to find the planks entirely rotted, but, to his surprise, found them sound, and, to use his own forcible expression, "as hard as a bull's horn." This was after they had lain exposed to all the vicissitudes of the atmosphere, and in contact with the surface of the earth about sixty years.

In the year 1800, a Mr. Atkinson, in the employ of the Hudson's Bay Fur Company, discovered, on Old Factory Island, in James' Bay, a branch of the Hudson's Bay, a cedar post, about a foot square and five feet high, on which the following inscription had been cut, and all the letters of which were distinctly visible:—"In the year 1692 wintered three ships at this Island, with one hundred and twenty-seven men, under the government of Captain James Knight. Then we erected this monument in remembrance of it."

This furnishes the greatest instance of duration of timber set in the earth, and constantly exposed to atmospheric influences, we have any where noticed, and we believe there are few kinds of timber which would endure so long. This notice does not state the kind of cedar employed, but, from its frequency on those islands and coasts, there can be no doubt of its being the red cedar, a kind which, as stated above, is almost imperishable.

Next to the kinds above stated, rank in durability the various kinds of pine and spruce; the white oak, chestnut, red elm, black walnut, and red beech; all furnishing timber of good quality, but not such as will, like the above, resist for a long period the attacks of time. In purchasing timber, price should not be so much regarded as quality and durability, as a rail or a post that will last fifty or sixty years, is worth far more than the usual difference charged between such, and those which will endure only twenty-five or thirty.

FORCE OF THE WATERS.

(From *Audubon's Ornithological Biography*, Vol. ii.)

It was the month of September. At the upper extremity of Dennisville, which is itself

a pretty village, are the saw-mills and ponds of the hospitable Judge Lincoln, and other persons. The creek that conveys the logs to these ponds, and which bears the name of the village, is interrupted in its course by many rapids and narrow embanked gorges. One of the latter is situated about half a mile above the mill-dams, and is so rocky and rugged in its bottom and sides as to preclude the possibility of the trees passing along it at low water, while, as I conceived, it would have given no slight labour to an army of woodsmen or millers to move the thousands of large logs that had accumulated in it. They lay piled in confused heaps to a great height along an extent of several hundred yards; and were in some places so close as to have formed a kind of dam. Above the gorge there is a large natural reservoir, in which the head waters of the creek settle; while only a small portion of them ripples through the gorge below, during the latter weeks of summer and in early autumn, when the streams are at their lowest. At the neck of this basin, the lumberers raised a temporary barrier with the refuse of their sawn logs. The boards were planted nearly upright, and supported at their tops by a strong tree extended from side to side of the creek, which might there be about forty feet in breadth. It was prevented from giving way under the pressure of the rising waters by having strong abutments of woodland against its centre, while the ends of these abutments were secured by wedges, which could be knocked off when necessary. The temporary dam was now finished. Little or no water escaped through the barrier, and that in the creek above it rose in the course of three weeks to its top, which was about ten feet high, forming a sheet that extended upwards fully a mile from the dam. My family was invited early one morning to go and witness the extraordinary effect which would be produced by the breaking down of the barrier, and we all accompanied the lumberers to the place. Two of the men on reaching it threw off their jackets, tied handkerchiefs round their heads, and fastened to their bodies a long rope, the end of which was held by three or four others, who stood ready to drag their companions ashore, in case of danger or accident. The two operators, each bearing an axe, walked along the abutments, and at a given signal knocked out the wedges. A second blow from each sent off the abutments themselves; and the men leaping with extreme dexterity from one cross log to another, sprung to the shore with almost the quickness of thought. Scarcely had they effected their escape from the frightful peril that threatened them, when the mass of water burst forth with a horrible uproar.

All eyes were bent towards the huge heap of logs in the gorge below. The tumultuous burst of the waters instantly swept away every object that opposed their progress, and rushed in foaming waves among the timber that every where blocked up the passage. Presently a slow, heavy motion was perceived in the mass of logs; one might have imagined that some mighty monster lay convulsively writhing beneath them, struggling with a fearful energy to extricate himself from the crushing weight. As the waters rose the movement increased; the mass of timber extended in all directions, appearing to become more and more entangled each moment; the logs bounced against each other; thrusting aside, demersing, or raising into the air those with which they came in contact: it seemed as if they were waging a war of destruction, such as ancient authors describe the efforts of the Titans, the flamings of whose wrath might to the eye of the painter have been represented to the angry curlings of the waters, while the tremulous and rapid motions of the logs, which at times reared themselves almost perpendicularly, might by the poet be taken for the shakings of the confounded and discomfited giants. Now the rushing elements filled up the gorge to its brim. The logs, once under weigh, rolled, reared, tossed and tumbled amid the foam as they were carried along. Many of the smaller trees broke across, from others great splinters were sent up, and all were in some degree seamed and scarred. Then in tumultuous majesty swept along the mingled wreck, the current being now increased to such a pitch that the logs, as they were dashed against the rocky shores, resounded like the report of distant artillery, or the angry rumblings of the thunder. Onward it rolls, the emblems of wreck and ruin, destruction and chaotic strife. It seemed to me as if I witnessed the route of a vast army, surprised, overwhelmed, and overthrown. The roar of the cannon, the groans of the dying, and the shouts of the avengers were thundering through my brain; and, amid the frightful confusion of the scene, there came over my spirit a melancholy feeling, which had not entirely vanquished at the end of many days. In a few hours almost all the timber that had lain heaped in the rocky gorge was floating in the great pond of the millers; and as we walked homewards we talked of the force of the waters.

CORNWALL POLYTECHNIC SOCIETY PREMIUMS, FOR 1837.

(Not confined to the County.)

A premium of ten guineas, by Sir Charles Lemon, Bart., and R. W. Fox, Esq., for the best report of a series of experiments made with the wedge for blasting rocks, invented

by R. W. Fox, Esq., which was described and figured in the last report of the society.

Two premiums, the first of seven guineas, the second of three guineas, by G. S. Borlase, Esq., for the best and second-best chemical or mechanical plans for ventilating mines, which can be applied to the Cornish mines with advantage.

A premium of ten guineas, by G. C. Fox, Esq., for the best essay on the various diseases incidental to miners, their causes, and the best practical means of remedying them. Any statistical information as to their longevity, compared with that of the other population of the county, will be deemed highly desirable.

A premium of ten pounds, by John Herle Tremayne, Esq., for the best available method or improvement on the plans already suggested, for facilitating the ascent and descent of miners, provided the judges shall consider it to possess sufficient merit to be entitled to the premium.

A premium of three guineas, by John Taylor, Esq., for the most complete and accurate accounts of the quantity of water supplied to the boilers, the number of bushels of coal consumed, and the duty performed by an engine, for a period of not less than six months in the ensuing year.

A premium of ten pounds, by the Rev. Canon Rogers, for the most economical, safe, and efficient plan for lighting mines, consistent with the health of the miner:—such plan to be accompanied by a statement of the present actual consumption of candles, and the cost per dozen lbs., at some of the principal Cornish mines.

Two premiums, the first of ten pounds, the second of five pounds, by H. H. Price, Esq., of London, civil engineer, one of the honorary members of this society, for the best and second best practical plans for adapting to steam vessels the method used in Cornwall, of working steam expansively; including practical drawings of the construction of the boilers and expansion-gear. Such boilers should combine economy of fuel with safety, both as regards the danger from explosion, and accidents to the vessel from fire: with suggestions as to the best method of preventing the loss of heat, by radiation or otherwise. Due regard must be had to the essential difference between a single acting engine working pumps by a lever, and two double acting engines working cranks.

Three premiums, by Charles Fox, Esq., the first of three guineas, for the best model (either original or copy) not less than eighteen inches in length, of a life boat, which shall be judged most manageable in a storm; the second premium of two guineas, for the second best; the third of one guinea, for the third best. Economy in the construction is a great desideratum.

Three premiums by Charles Fox, Esq., the first of three guineas, for the best description and drawings of the least inconvenient and inexpensive, and, at the same time, most efficient means of securing a fortnight's supply of bread and water, within reach of a ship's crew, in the event of their not being able to go below deck, owing to the vessel being water-logged, or to other causes; the number of the crew may be estimated in the proportion of 15 tons register to each man. The second premium of two guineas, for the second best; the third of one guinea, for the third best.

All plans should be accompanied with accurate models or drawings, estimates of expense, and all the information necessary to enable the judges appointed for the purpose, to form a correct judgment of their respective merits.

Should several plans for any premium be proposed by the same person, a model of one, with accurate drawings and estimates of the others, will be sufficient: no individual to be entitled to more than one premium, where two are offered for the same object.

The judges will be requested to withhold any of these premiums, provided no plans be brought forward, which they shall deem of sufficient importance to merit them; the premiums will then be continued to another year.

Competitors for the foregoing premiums are requested to send their plans, &c., *free of expense*, to the secretaries, one month before the next exhibition, of which due notice will be given.

Charles Fox, Esq., offers to the society, as long as he continues a member of it, the sum of four pounds annually; to be distributed in the respective sums of two pounds, one pound, twelve shillings, and eight shillings, in four several prizes, for the neatest, and most correct maps of some one state, province, or European colony, comprising not less than 144 square miles; or a portion of not less than 100 square degrees of some uncivilised region.

These prizes to be called the *Lander Prizes*, in commemoration of those enterprising travellers, Richard and John Lander. The principal rivers, lakes, chains of mountains, line of coast (if any), and territorial line, should be accurately delineated; and the size of the most important cities, or towns, with their latitudes and longitudes, should be correctly marked. The maps should be accompanied by the fullest practical information (with reference to authority), either respecting the principal river flowing through the country, selected, as it

relates to the length of its course, breadth at different places, tributary streams, lakes and canals, the periodical rise, average fall per mile, and rapidity of its current; the progressive increase of alluvial deposit in its formation, and the obstructions which may be opposed to its navigation;—or respecting the physical characters of the principal chain of mountains in such country, their general direction, respective heights, geological features, more important passes, limit of perpetual snow, and the elevations at which various trees and plants will flourish on their sides.

STEAM-BOILER EXPLOSIONS.

(To the Editor of the *Manchester Guardian.*)

Sir,—The many fatal accidents occurring from the bursting of steam-engine boilers call loudly for the investigation of every humane person who is at all acquainted with the nature of the subject. It is now a prevailing opinion that some legislative enactment is requisite, and that, in such localities as Manchester, inspectors ought to be authorised to examine boilers from time to time; but there are many objections that may be urged to such a plan. With submission to you, Sir, I would say that the press, which is always capable of effecting so much when directed to the promotion of religion and public morals, has not yet effected much good in relation to this matter; nay, I would almost venture to assert, that the newspaper press, generally, has done harm, and most commonly from a total omission of the details necessary to elucidate each case, or when any particulars are given, I am sorry to observe, they are too frequently exaggerations of such of the facts as relate to the tremendousness of the explosion, the violent concussion, loud report, &c., &c., almost always evidencing the writer's inclination rather to make a striking report in the newspaper than any thing else.

To the foregoing general censure there are, of course, some honourable exceptions; amongst which your paper stands prominently forward, and, if your example was generally followed, but more particularly by the reporters for the London newspapers, I have no doubt that much might be done towards devising means of preventing such lamentable occurrences.

A few general directions and questions adapted to elicit the most important particulars in all possible cases of the kind, are not only a *desideratum* as a guide to direct the inquiries of the reporter, but seem absolutely necessary to such of the public as are liable to be called on as jurymen. With this object in view, I have drawn up the following rules, at the same time considering that brevity is essentially necessary to render any thing of the kind practically useful:—

1. What was the length, breadth, and depth of the boiler, and the thickness of the metal of which it was made?

To this may be added its probable or reputed weight.

2. What was the kind or shape of the boiler, and its reputed horse-power?

Here it is perhaps necessary to remark, that in giving answers to this, as well as the other questions, it will best to adhere to the terms in common use; for instance, distinguishing whether the boiler is of the old-fashioned or round kind, such as are generally used at collieries, and commonly called the haystack boiler; the common oblong or waggon-shaped boiler, sometimes called the Boulton and Watt boiler, as being generally used with low pressure engines: they are well known, and commonly used in factories; or, the cylindrical boiler, commonly used for high pressures, and frequently called a barrel boiler, a not very inappropriate designation, when applied to the cylindrical boiler with flat ends, which ought always to be carefully distinguished from the cylindrical boiler with spherical ends, the latter being certainly the safest of the two.

There are also modifications of the locomotive and the marine boiler being partially introduced, but they are merely combinations of the more simple forms.

3. Was it a flue boiler?—that is, had the boiler one or more internal flues or tubes, through which the fire passed on its way to the chimney? These are sometimes, erroneously as I think, called tube boilers, which is liable to confound them with the tubular boilers of Woolf, Gurney, and others, in which the water is wholly confined in tubes or cylinders of small dimensions, and said to be the only safe high pressure boilers.

4. Where was the furnace or fire-place situated? distinguishing whether the stoking hole is at the end, or one side of the boiler; and also whether the furnace is placed within the internal flue, as in marine, and some high pressure boilers, or in a fire-box attached to the end of the boiler, as in locomotives, or underneath the bottom of the boiler, which is the common mode.

5. What was the method of firing or supplying the furnace with fuel? whether by a machine or by hand; and whether any, and what, system of smoke burning was used?

6. In what manner was the boiler supplied with water? that is, whether under the pressure of a column of water in what is called the common feed pipe, with a self-acting float and feed valve (in such case ascertain the height of the cistern on the top of the feed pipe, above the level of the water in the boiler), or by the force pump, direct to the

boiler, as in high pressures; or by hand, that is, by occasionally turning a tap in a pipe connected with an elevated cistern, which is the most dangerous mode of any, and I am sorry to observe, becoming too prevalent; also state whether any, and what kind of water gauges are used.

7. What was the usual working pressure of steam in the boiler, say in pounds per square inch, and the mode in which it was ascertained? Whether by the common steam gauge, which is undoubtedly the best; it is an inverted syphon, about half filled with mercury, and carrying a wooden peg or float marked with inches, each of which is very nearly equal to one pound per square inch pressure.

8. Was there a safety-valve, and if so, where was it situated? Whether directly on the boiler itself, or on the steam-pipe leading to the engine, which last is the usual mode, as by that means one safety-valve does for two or more boilers? This is an important distinction, as it is well known that the disastrous calamity at the late Mr. Goodier's calendar-house arose partially from an oversight in this matter; notwithstanding, it is to be regretted that the practice is yet far too common.

9. What was the load upon the safety-valve? and state whether it was applied directly to the valve, or through the intervention of a lever: state also the area of the valve in circular inches (that is, the square of the diameter of its seat), which admits of a very easy comparison to the pressure indicated by the height of the feed-pipe, each yard in height of which, corresponding very nearly with each pound per circular inch on the safety-valve; and this again is easily compared to the pressure per square inch, as indicated by the steam-gauge, which ought to be nearly in proportion of 78½ to 100.

10. What was the precise time at which the explosion took place? that is, relatively to the time of the engine working. Whether it took place previous to the engine starting in the morning during the getting up of the steam, or was it during any incidental stopping of the engine when the water is liable to get too low? It may be observed, that many explosions have occurred on Monday mornings after the boilers had been recently cleaned out, an operation which is frequently performed on the Sunday evenings; and from the necessary haste in such cases, a careless engineer will only imperfectly refill the boiler with water.

To the above ten requisites it is almost necessary to add, that should there be other boilers working in connexion with the one that has burst, it may be useful to have a somewhat similar description of them as of the one in question. A few particulars may also be required with respect to the engine itself.

1. The size or power of the engine—that is, its reputed horse-power. Where this is not easily obtained, it may be very readily estimated by allowing 25 circular inches area of the cylinder for each horse-power, that is, divide the square of the cylinder's diameter in inches by 25, and the result will always give a fair average for the Boulton and Watt, or low-pressure engine.

2. The kind of engine, that is, whether a low-pressure condensing-engine, generally called a Boulton and Watt engine, or a high-pressure non-condensing engine, sometimes called the Trevithick engine; there is also another kind of steam-engine, said to combine the advantages of both the other kinds, called the high-pressure condensing-engine, but this last is rarely to be met with out of Cornwall.

Should this paper meet your approval, I shall be glad to return to the subject at a future opportunity.

Yours, &c.

A PRACTICAL MECHANIC.

Manchester, Dec. 10, 1836.

LIST OF ENGLISH PATENTS, GRANTED BETWEEN THE 28TH OF NOVEMBER AND THE 24TH OF DECEMBER, 1836.

William Sneath, of Iron Green, Nottingham, lace-maker, for improvements in producing embroidery or ornaments on muslins, silks, and certain other fabrics. Nov. 28; six months to specify.

Alexander Stocker, of Bardesley Iron Works, and Henry Downing, of French Walls Iron-Works, both of Birmingham, gentlemen, for improvements in manufacturing rivets, screw blanks, and other articles. Nov. 29; six months.

David Nunes Carvalho, of Fleet-street, London, bookseller, for certain improvements in propelling or moving vessels and other floating bodies on water and carriages on land; which improvements are applicable to windmills and other purposes; being a communication from a foreigner residing abroad. Dec. 3; six months.

Robert Armstrong, of Stonehouse, Devon, doctor of medicine, for certain improvements in the water-pressure engine, rendering it more generally applicable for raising water and other substances, and as a motive-power. Dec. 3; six months.

Moses Poole, of Lincoln's-inn, Middlesex, gentleman, for machinery for a method of generating power applicable to various useful purposes; being a communication from a foreigner residing abroad. Dec. 3; six months.

James Corbett, of Richmond-place, Limerick, Ireland, professor of music, for certain improvements in producing harmonic sounds on the harp. Dec. 3; six months.

Jacob Perkins, of Fleet-street, London, engineer, for certain improvements in steam-engines, furnaces, and boilers; parts of which improvements are applicable to other purposes. Dec. 3; six months.

George Sullivan, of Morley's Hotel, Charing Cross, Middlesex, gentleman, for improvements in machinery for measuring fluids; being a com-

communication from a foreigner residing abroad. Dec. 3; six months.

Henry Booth, of Liverpool, Lancaster, Esq., for certain improvements in the construction and arrangement of railway tunnels, to be worked by locomotive-engines. Dec. 3; six months.

Thomas Don, of James-street, Golden-square, Middlesex, gentleman, for certain improvements in preparing and drying grain, seeds, or berries, and for manufacturing them into their several products; which improvements are applicable to other useful purposes. Dec. 3; six months.

William Bryant and Edward James, of Plymouth, Devon, merchants and co-partners, being of the people called Quakers, for improvements in the manufacture of liquid and paste-blacking, by the introduction of India-rubber, oil, and other articles and things. Dec. 3; two months.

William Hancock, of Windsor-place, City-road, Middlesex, gentleman, for certain improvements in bookbinding. Dec. 7; six months.

Henry Adcock, of Mount Pleasant, Liverpool, Lancaster, civil engineer, for certain improvements in the raising of water from mines and other deep places. Dec. 9; six months.

Frederic Bart Zincke, the younger, of Crawford-street, Marylebone, Esq., for the preparing or manufacturing of the leaf of a certain plant, so as to produce a fibrous substance not hitherto used in manufactures, and its application to various useful purposes. Dec. 9; six months.

Samuel Pratt, of Peckham Rye, Surrey, gentleman, for certain improvements in the construction of knapsacks, portmanteaus, bags, boxes, or cases for travellers. Dec. 9; six months.

Lemuel Wellman Wright, of Manchester, Lancaster, engineer, for certain improvements in machinery or apparatus for bleaching or cleansing linens, cottons, or other fabrics; goods or other fibrous substances. Dec. 9; six months.

John Yates, of the parish of Saint Anne, Limehouse, Middlesex, for certain improvements in train-roads or railways, and in the wheels or other parts of carriages to be wheeled thereon. Dec. 9; six months.

George, Marquis of Tweeddale, for an improved method of making tiles for draining, soles, housetiles, flat-roofing tiles, and bricks. Dec. 9; two months.

John Melling, of Liverpool, Lancaster, engineer, for certain improvements in locomotive steam-engines to be used upon railways or other roads; part or parts of which improvements are also applicable to stationary steam-engines, and to machinery in general. Dec. 15; six months.

Richard Thomas Beck, of the parish of Little Stonham, Suffolk, gentleman, for new or improved apparatus or mechanism for obtaining power and motion, to be used as a mechanical agent generally, which he intends to denominate "Rotæ Vivæ;" being a communication from a foreigner residing abroad. Dec. 15; six months.

William Sharpe, of the city of Glasgow, North Britain, merchant, for a certain improvement in the treatment of cotton-wool, in preparation for manufacturing the same into yarn and thread; being a communication from a foreigner residing abroad. Dec. 15; six months.

Robert Waller Swinburne, of South Shields, Durham, agent, for certain improvements in the manufacture of plate-glass. Dec. 15; six months.

James Torry Hester, of Abingdon, Berks, surgeon, for an improvement in the constructing of chairs. Dec. 15; six months.

Thomas Routledge and Elijah Galloway, of Water-lane, London, gentlemen, for certain improvements in cabriolets and omnibuses. Dec. 19; six months.

Thomas Elliott Harrison, of Whitburn, Durham, engineer, for certain improvements in locomotive-engines. Dec. 21; six months.

Andrew Smith, of Princes-street, parish of Saint Martin-in-the-Fields, Westminster, engineer, for certain improvements in the construction of standing rigging and stays for ships and vessels, and in the method of fitting or using it, and in the construction of chains applicable to various purposes, and in machinery or apparatus for making or manufacturing such rigging and chains. Dec. 21; six months.

John Crighton, of Manchester, for a certain improvement or improvements in the construction of cylinders used in carding-engines, employed for carding cotton, wool, silk, and other fibrous materials. Dec. 21; six months.

James Potter, of Manchester, cotton-spinner, for certain improvements in spinning-machinery. Dec. 21; six months.

John Swindells, of Manchester, manufacturing chemist, for certain improvements in the process of effecting the decomposition of muriate of soda or common salt. Dec. 21; six months.

George Houghton, of High Holborn, Middlesex, glass merchant, for a certain improvement or certain improvements in the construction of lamps; being a communication from a foreigner residing abroad. Dec. 21; six months.

Stedman Gillet, of Guildford-street, gentleman, and John Chapman, of Paddington, mechanist, for certain improvements in that description of vehicles called cabs. Dec. 21; six months.

William Gossage, of Stoke Prior, Worcester, chemist, for certain improved apparatus for decomposing common salt, and for condensing and making use of the gaseous product of such decomposition, also certain improvements in the mode of the conducting these processes. December 24; six months.

Bennet Woodcroft, late of Ardwick, Manchester, but now of Mumps, in the township of Oldham, gentleman, for an improved mode of printing certain colours on calico and other fabrics. Dec. 24; six months.

LIST OF SCOTCH PATENTS, GRANTED BETWEEN THE 24TH OF NOVEMBER AND 17TH OF DECEMBER, 1836.

Joseph Whitworth, of Manchester, engineer, for certain improvements in machinery, tools, or apparatus, for turning, boring, planing, and cutting metals and other materials. Sealed Nov. 24.

William Watson, of Liverpool, merchant, for an invention, communicated by parties residing abroad, of certain improvements in the manufacturing of sugars from beet-root and other substances. Dec. 3.

Robert Copland, of Cowland, Wandsworth-road, Surrey, engineer, for combinations of apparatus for gaining power. Dec. 5.

Henry Huntley Mahun, of Walworth, in Surrey, doctor of medicine, for improvements in the manufacturing of fuel. Dec. 5.

William Sneath, of Ison-green, lace-maker, for certain improvements in machinery, by aid of which improvements thread-work ornaments of certain kinds can be formed in net or lace made by certain machinery, commonly called bobbin-net machinery, and on other fabrics. Dec. 9.

Thomas Henry Russell, of Handsworth, near Birmingham, tube-maker, for improvements in making or manufacturing welded iron tubes. Dec. 9.

John Buchanan, of Ramsbottom, Lancaster, millwright, for an improved apparatus for the purpose of dyeing and performing similar operations. Dec. 9.

Luke Hebert, of Paternoster-row, London, civil engineer, for certain improvements in mills or machines for grinding and sifting farinaceous and other substances. Dec. 9.

John Gordon Campbell, of Glasgow, merchant, and John Gibson, of the same city, throwster, for a new or improved process or manufacture of silk, and silk in combination with certain other fibrous substances. Dec. 9.

Joseph Hanson, Hinckley, Leicester, architect, for an improved vehicle for the conveyance of various kinds of loads upon common and other roads. Dec. 9.

James Elnathan Smith, of Liverpool, merchant, for an invention, communicated by a foreigner residing abroad, of certain improvements on railways, and on locomotive-carriages to work on such railways. Dec. 17.

Daniel Chambers, of Carey-street, Lincoln's-inn, water-closet manufacturer, and Joseph Hall, plumber, of Margaret-street, Cavendish-square, for an invention of an improvement in pumps. Dec. 17.

George Gwynne, of Holborn, gentleman, and James Young, of Brick-lane, brewer, for improvements in the manufacture of sugars. Dec. 17.

NOTES AND NOTICES.

The British Association for the advancement of science, holds its next meeting at Liverpool, in the month of September. As the railway almost annihilates the distance between Liverpool and Manchester, and will doubtless be put into considerable requisition on the occasion, the meeting may be said to be held at both places united, or at the "manufacturing capital" of England. Thus each meeting since the commencement will have been held in a place ranking, in some degree, as a metropolis. In 1831, at York, the capital of the North of England; in 1832 at Oxford, and in 1833 at Cambridge, the two capitals of learning; in 1834 at Edinburgh, and in 1835 at Dublin, the capitals of Scotland and Ireland; and in 1836 at Bristol, the capital of the West of England. Birmingham will probably be the next point of union, in virtue of its station as "the midland metropolis."

The "Hydraulia" of our valuable correspondent, Mr. Matthews, seems to have excited some sensation among the scientific circles of Paris, if we may draw such an inference from the fact of its having formed the basis of three very long and elaborate articles in the celebrated "*Journal des Savans*," in which the writer enters with considerable interest on an examination of the details furnished by Mr. Matthews, respecting the supply afforded by the respective London water-companies, and dwells with great gusto on the minutest points of the history of Sir Hugh Myddelton's great work, "*la Nouvelle Rivière.*"

The Institute of British Architects, recently established, is rapidly becoming a very flourishing establishment. Members, not only from the United Kingdom, but many parts of the Continent and the United States of America, join in great numbers at every meeting, and the finances have just been swelled by the donation from several members of their share of the money received at the doors of the exhibition of Designs for the New Houses of Parliament, to which exhibition they were contributors.

Aerolites.—A short time since an attempt was made to prove, that amongst all the different descents of aerolites, there was not a single example of any one being killed by them. Since then, M. Babinet, son-in-law to Professor Laugier, has sent a note on this subject to the French Academy of Sciences, with a fragment of an aerolite, belonging to the collection of M. Laugier, which fell near Roquefort, in America, and, making a hole five feet in size, crushed two men in a cottage, by the falling in of the roof. M. Eyriés also states, that Olaüs Eriscon Willman, a Swedish sailor, in the service of the Dutch East India Company, in 1647, had declared, that whilst at sea, and the vessel under a press of sail, a stone, weighing eight pounds, fell on deck, and killed two men. Mr. Warden has communicated to the Academy, that an event of the like nature took place in Georgia, in 1826, and occasioned the death of several persons; and, moreover, that in July, 1829, an Indian, named Alika, lost his life in the same manner.

Barton's New Self-acting Pump.—Mr. Barton, the inventor of a new patent self-acting pump, had the honour of a long interview with Earl Minto, and other Lords of the Admiralty, lately, relative to the above invention, the principal object of which is to supersede manual labour on board ships at sea, and to increase their safety and salubrity. It is, however, capable of being applied to various other purposes, such as the working of mines, or in all cases in which considerable quantities of water are required to be raised. The invention appeared to excite their Lordships' warm approbation, and there is every probability of its being introduced into his Majesty's Navy.

"A Mechanic" informs us, that he made about six months ago a sofa-bedstead, expanding instead of turning up. He invites our correspondent, T. A. Croft, to see it; his address may be had at our office. Will "A Mechanic" favour us with a description of his bedstead?

The Supplement to Vol. XXV., containing Title, Table of Contents, Index, and Plate of Specimens of English Medallic Engraving by Mr. Bate, was published on the 1st of December, price 8d.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

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MR. VIGNOLES' SYSTEM OF LONGITUDINAL TIMBERS FOR THE UPPER WORKS OF RAILWAYS.

Fig. 1.

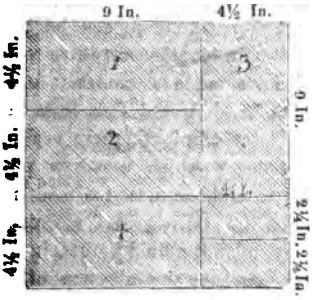


Fig. 2.

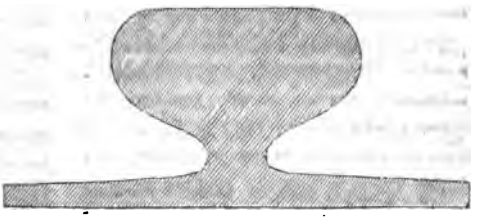


Fig. 3.

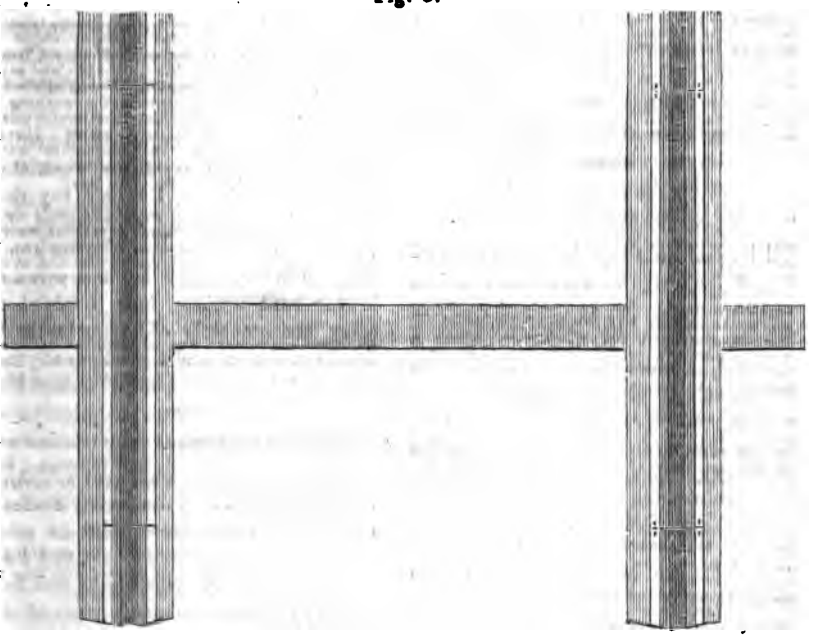
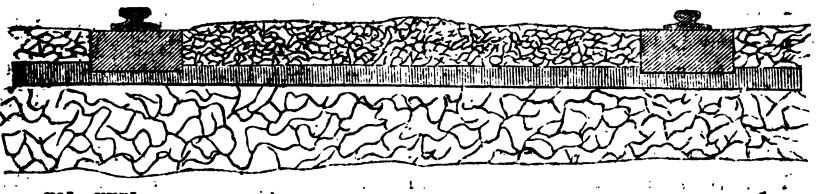


Fig. 4.



MR. VIGNOLES' SYSTEM OF LONGITUDINAL TIMBERS FOR THE UPPER WORKS OF RAILWAYS.

Report from Chas. Vignoles, Esq., C. E., to the Directors of the Midland Counties Railway.

Gentlemen,—I have in a former Report submitted to you, and I beg again to urge the propriety and policy of the Directors taking into their most serious consideration, the mode of executing the *upper works* of the railway in a more economical, and, in my judgment, in a better manner than the method adopted on the London and Birmingham Railway, and some of the other principal lines now in course of construction—I mean the adoption of a railway-bar of a peculiarly strong section, though lighter than usual, to be laid upon half baulks of Kyanised timber, longitudinally placed and supporting the rail throughout its entire length without chairs, or with chairs at the joints only, the rail being nailed or spiked down on the timber.

I have already explained that the motion of the trains on a railway thus laid will be much easier, and indeed I believe this is admitted on all hands; such a line will be much more cheaply kept in repair, and vastly less damage from concussion and vibration will be sustained by the engines and carriages, and by the road itself.

I have been studying this subject at every available moment for a long time, and, from the experience of eighteen months on the Dublin and Kingstown line of the *longitudinal timbers,* I am more and more convinced that the true principle of forming the upper works of a railway is by placing the rails sustained throughout the entire length on wood—and as soon as it is resolved to sustain the rail in this manner throughout, it follows as a consequence that cast-iron rails may at once be thus placed in preference to, or, at all events, in competition with wrought-iron rails.

The chief objection against the cast-iron rail has ever been the number of joints, but I have ascertained that rails of the pattern I recommend, *can* be cast with accuracy in lengths of twelve feet; indeed, I have made a contract for a quantity to be delivered free from all warp; and this admitted, there are several advantages which cast-iron possesses over wrought-iron, that will justify its adoption for railway-bars sustained throughout on longitudinal timbers in the manner I propose; the absence of all lamination on the bearing surface, and the bringing of the manufacturers of wrought and cast-iron into greater competition for the supply of Railway Companies, are each important features in the case.

If it would be any argument to gentlemen who are quite capable of exercising their own judgment, I should say that two or three Railway Companies, for whom I am engineer, and who are about to apply to Parliament for incorporation in the next sessions, have resolved to adopt the principle of laying rails on baulks of timber, and I shall equally recommend it to several other Companies for whom I am concerned as principal or as consulting-engineer.

The accompanying statement will show the manner in which the saving is effected; I have taken great pains to price every thing as fairly as possible, and I am persuaded that for stone blocks and ballasting, the price on many parts of the Midland Counties Railway will exceed what I have estimated; from the great distance of land-carriage of the stone, and the want of ballasting materials in the district, I am indeed of opinion that the ultimate saving will be for this Company 2,000*l.* per mile—and looking to the system extending to other parts of the country, I venture to assert that in

the alluvial districts of England the difference will often amount to more.

The saving of 2,000*l.* per mile upon the whole sixty miles authorised for construction under the Company's Act is no less than 120,000*l.*—an item much too large to be put aside without the greatest consideration from the Directors.

Looking at the question in the most discouraging light, little or no loss can accrue to the Company from the adoption of the measure—admitting the necessity of renewing the timber every seven years, the total cost at the end of twenty years will scarcely be more than the present positive outlay, and we have a right to claim credit for compound interest on the saving of first capital—besides, blocks and chairs break and require renewing, and there can be no question of the much greater annual economy of keeping such a line as I propose in repair, and the less destructive effect on the trains.

The preference which might be made of wrought-iron over cast-iron cannot interfere with a principle which rests solely on the placing a continuous support of timber below the rail, dispensing with the use of chairs.

The substitution of wrought-iron would however allow a lighter rail, but with wrought-iron the amount of saving would be from 200*l.* to 400*l.* per mile less than by adopting cast-iron.

In the subsequent comparison I have stated the expense of the railway laid on stone blocks and also on sleepers; I have a right to consider the whole as laid on blocks, and I calculate as if this were done in the first instance; but practically the estimate will be increased, inasmuch as sleepers are laid on embankments with the avowed intention of being replaced after a few years by blocks.

The scantling of timber I have selected has been fixed by having determined the economy which would arise by using Brack or second Memel timber, which can be procured in baulks of nearly equal section throughout, and varying very little more than from about 13½ to 14 inches square. The annexed diagram will show the manner in which this baulk would be cut *without waste* into four pieces, each 9 inches wide by 4½ inches deep, marked 1-2-3-4, leaving the piece in the corner to be sawn up, to form gauge or tie-pieces.

In selecting these tie-pieces of timber, I have considered that they come in almost for nothing, but if an equal economy in the sawing up of the timber can be otherwise obtained, wrought-iron rods of small diameter might be placed every three or four yards, solely for the purpose of keeping the railway track in gauge.

The rail I have selected will weigh in cast-iron about 48lbs. per lineal yard. If of wrought-iron it would be reduced (by diminishing the thickness of the lower bearing) to 42lbs. per yard. The annexed diagram exhibits a full-sized section of the rail, having a base of 5 inches, and the button or upper web as large as that of the heaviest rails yet made, while the stiffness of the whole is remarkable.

The timber being laid on its broadest side, the rail will be spiked or nailed down thereupon, the gauge of the track between the two rails being preserved by the 2-inch tie-pieces 7 feet 6 inches long, being let into the longitudinal timbers at intervals of 7½ feet.

The statement as follows is drawn up as the comparative estimate of the cost of the present mode of laying rails on stone blocks and on wood sleepers, and of the proposed method for laying the railway, on the line of the Midland Counties Railway, and which with the necessary addition for the extra price of materials and extra carriage, may serve for most of the railways throughout Great Britain and Ireland.

Estimate of the Present and of the Proposed Methods of Laying Railways computed for the Cost of One Lineal Yard of Double Trackway.

PRESENT MODE OF LAYING RAILS.

ON LARCH SLEEPERS.

	s.	d.
Kyanized Larch Sleepers, containing about 2 cubic feet of timber at 4s. 6d. each (placed at intervals of 4 feet), two sleepers for a double track equal to per yard	6	9
Ballasting, including the rubble drains in the bed of the road, 4 cubic yards in a yard forward, at 2s.	8	0
Rails, 62 lbs. per yard of wrought-iron, at 13*l.* per ton.—Chairs, 18 lbs. each, and Joint Chairs, 20 lbs. (placed at intervals of 4 feet), equal to 14 lbs. per yard of cast-iron, at 10*l.* per ton, including carriage and delivery on ground	33	10
8 Spikes, 3d. each; 4 compressed wood Keys, 4½d. each; chairing two Sleepers, 2½d. each, equal to per yard (the intervals being of 4 feet)	2	11
Laying Railway, including boxing up and adjusting	1	6
Total per yard of double track or 4664*l.* per mile.	53	0

ON STONE BLOCKS.

	s.	d.
Stone Blocks, of 5 cubic feet each, at 4s. each (placed at intervals of 4 feet), four blocks per double track, which is equal to per yard	12	0
Ballasting, including the rubble drains in the bed of the road, 5 cubic yards, in a yard forward, at 2s.	10	0
Rails, 62 lbs. per yard, of wrought-iron, at 13*l.* per ton.—Chairs, 18 lbs. each, and Joint Chairs 20 lbs. (placed at intervals of 4 feet) equal to 14 lbs. per yard, of cast-iron, at 10*l.* per ton, including carriage and delivery on ground	33	10
8 Spikes, at 3d. each; 4 compressed wood Keys, 4½d. each; 4 Felts, 1d. each; chairing and drilling four Blocks, 3d. each (the intervals being of 4 feet), equal to per yard	3	7
Laying Railway, including boxing up and adjusting	2	7
Total per yard of double track or 5456*l.* per mile.	62	0

Sleepers are considered a temporary expedient, and are calculated to be re-placed after a certain term with Stone Blocks; and supposing one-third of the Railway to be at first laid on sleepers, the loss would be 8s. 7d. per yard, or as one-third only is laid 2s. 10d. per yard, or 210*l.* per mile, to add to the ultimate cost of the Road, making it amount to 64s. 10d. per yard, or 5666*l.* per mile.

The first cost of a Railway, two-thirds being laid on Stone Blocks and one-third on Sleepers, would be 5192*l.* per mile.

PROPOSED MODE.

ON MEMEL BAULKS.

	s.	d.
Brack or 2nd Memel Timber, 13½ to 14 inches square, cut into 4 slabs of 9 × 4½ inches; the extra piece cut into tie or gauge pieces, 2 inches thick and 7½ feet long, to be placed at every 2½ yards length; in all 3⅗ or say 4 cubic feet at 2s. 8d. per cubic foot, cut and Kyanized	10	8
Ballasting, including the rubble drains in the bed of the road, 4 cubic yards, in a yard forward, at 2s.	8	0
Cast-Iron Rails, 48 lbs. per yard, at 10*l.* per ton, including carriage and delivery on the ground.—N.B. Wrought-iron Rails, 42 lbs. per yard, would be 19s. 6d., and wrought-iron Rails, 48 lbs. per yard, would be 22s. 3d., at 13*l.* per ton	17	2
11 Spikes, per yard, the holes for spiking down being cast with the Rail (nothing else is required) at 1½d. per spike	1	5
Laying Railway, including Scarfing, Baulks, Ties, and adjusting	1	9
Total per yard of double track or 3432*l.* per mile.	39	0
With wrought-iron Rails, of 42 lbs. per yard or 3637*l.* per mile.	41	4
With 43 lbs. wrought-iron Rails or 3762*l.* per mile.	42	9
With 48 lbs. wrought-iron Rails or 3879*l.* per mile.	44	1

The following is a Comparative Abstract of the Total Cost per Mile of the Upper Works of a Railway according to the several preceding stated methods:—

	Per Mile of Double Tracking.
Ultimate cost under the present system of a railway, laid on stone blocks, with 62 lbs. wrought-iron rails, after replacing one-third assumed to have been temporarily laid on larch sleepers in the first instance	£5666
First cost of a railway wholly laid on stone blocks with similar rails	5456
First cost of a railway laid two-thirds on stone blocks and one-third on larch sleepers, with similar rails.....	5192
First cost of a railway wholly laid on larch sleepers with similar rails.....	4664
First cost *under the proposed system* of a railway laid on longitudinal baulks of memel timber, with 48 lbs. wrought-iron rails	3879
Ditto ditto ditto with 45 lbs. wrought-iron rails	3762
Ditto ditto ditto with 42 lbs. wrought-iron rails	3637
Ditto ditto ditto with 48 lbs. cast-iron rails	3432

It will thus be manifest that there is an economy varying from 800*l.* to 2200*l.* per mile, and that the most disadvantageous comparison of the proposed with the present system, exhibits a saving in its favour equal to once wholly removing the longitudinal timbers, while taking the 42 lbs. wrought-iron rail, which, if wrought-iron should be preferred, I recommend as quite sufficient, and comparing it with first cost of a railway wholly laid on stone blocks, there is an actual saving of 1800*l.* per mile, or comparing it with a railway laid two-thirds on stone and one-third on larch sleepers, there is a positive saving of upwards of 1500 per mile in the first instance, and an ultimate saving of full 2000*l* per mile.

I have the honour to be, Gentlemen,

Your very obedient servant,

CHARLES VIGNOLES, Engineer.

4, Trafalgar-square, London, Nov. 25, 1836.

Explanation of the Engravings.

Fig. 1 is a diagram of a Memel baulk, 13½ to 14 inches, sawn into railway scantlings. Fig. 2, section of a railway-bar, adapted to longitudinal timbers of this description; weight in wrought-iron 42 lbs. per yard. Figs. 3 and 4, plan and section of the railway as laid.

THE INSURANCE-COMPANIES v. THE PUBLIC.

"Lay on, Macduff."

Sir,—I fear many of your readers are getting pretty well tired of the insurance question; however, there are a few points in the last two letters of P. R. and FIRE-FURY, upon which I must trouble you with a few remarks.

These writers both profess to be of the "commonalty," knowing but little about these matters, and affect to defer to my "knowledge and experience;" yet, *they* will know best after all. P. R. (p. 217,) says, "there is no analogy in the case of the Insurance-Companies and that of a private individual;" what compose these companies but private individuals? Does the mere joining of one or more persons in trade make them cease to be private individuals? Certainly not.

P. R. further argues, that "by taking upon themselves the administration of a *fire-police*, the companies tacitly guarantee protection to the *insurers*." From this sentence it would appear that it is the *insurers* who now complain; 'tis no such thing. Neither have the Insurance-Companies taken upon themselves the administration of a *fire-police*; they have never possessed the *authority*, nor incurred the *responsibility* of such an office. Nor can such a responsibility ever be fixed upon them.

Without attempting to show the fallacy of the argument set up by P. R. with reference to the Gas and Water Companies, suffice it to say the cases are not parallel. The municipal fire-establishments may aptly be compared with those companies, but not the servants of the fire-offices.

P. R. has made one mistake at which I am very much surprised, as the opportunity of ascertaining the truth is freely open to every body, and putting forward such a statement as the following, argues much carelessness in looking round for

information relative to the question now at issue.

P. R. tells us that the Insurance-Companies incur a risk so enormous, that they are utterly unable to realise any thing like the amount, should they be called upon to do so. In my last communication I stated the amount of property standing at the risk of the London fire-offices to be nearly four millions sterling. Now the *real and invested capital* of those offices is well known to be considerably above three times that amount; how can P. R. then venture to make such a statement?

The capital of most of the Insurance-Companies, and the amount of insurances actually effected, are continually before the public, and very little trouble is requisite for obtaining an accurate knowledge of this branch of the subject.

Fire-Fury (p. 227,) bursts forth with the startling announcement that "facts are stubborn things," and so he will most likely find them ere this discussion ends. With respect to the one he has sent for my digestion, my appetite's so good it scorns such trifles, and having well smoked, it, I return the savory morsel for his own devouring. Fire-Fury being fairly beaten out of London—finding that the *insurers* do not, and that the *uninsured* have no right to complain; that the *public* will not entertain his question—he has adjourned the discussion to Manchester. Proceed we there to meet him, being quite as much at home in the fire-department at Manchester as in London.

Perhaps Manchester is a very eligible town for our purpose, seeing that the PUBLIC and not the *Insurance-Companies*, afford the required protection, by means of an efficient *fire-police*.

I should have been much better pleased had Fire-Fury in common fairness have given the whole description (not a long one,) of "the destructive fire at Messrs. Faulkner and Owen's cotton factory," in lieu of the garbled extract he has endeavoured to turn to his purpose. In the first place, however, we will exhibit one small dose to Fire-Fury, in the shape of a *fact*. Being one of "the commonalty," of course he cannot know till he is told, that the Manchester town-engines (at least, three of them), which he calls "*useless squirts*," are twice as powerful as our London engines; each of them being equal in power to Braithwaite's steam fire-engine! So much for *fact*.

Because the misguided persons, whom Fire-Fury designates as "scoundrels," and "the cold-blooded vindictive mob," showed none of the usual disposition to aid the firemen, he imagines a steam fire-engine would have made all right in no time.

This, however, is another sad mistake; in the present instance it is true, after the fire had been kindled, the crowd were content to stand neuter while the destroying element and the firemen contended for the mastery. Fire-Fury does not—but the Manchester paper does—tell us that the fire was stopped in its progress by Mr. Rose and his brave firemen (with the aid of their "*useless squirts*"), maugre the help of the mob; thereby saving considerable property, which, says Fire-Fury, "the steam fire-engine would have done without aid from any one."

But suppose, good Fury, that this same unruly mob had not been pleased to allow a steam fire-engine to put out a fire which they, or some one of them, had taken the trouble to kindle; they have cut one gash in the suction-pipe of the steam fire-engine, and farewell to its miraculous powers.

The fact is, that it is exceedingly difficult, if not quite impossible, to guard effectually against calamities arising out of the bad blood generated by long-protracted differences between masters and their workmen; but as far as the *cant* of the "*House-burning system*" is concerned, Manchester had better be let alone; protected as it is, by a well-organised *fire-police*, provided with the most powerful engines at present in use, and suffering a smaller loss by fire annually, in proportion to its extent and the property it contains, than almost any other town in England.

Methinks Fire-Fury smells something of this, for in his concluding paragraph he skips back to London and flounders among the Insurance-Companies once more. I pray you, gentle Fury, discriminate between Manchester, where the *public* provide against the spread of fires, and London, where every species of prevention is laughed to scorn, and every mode of suppression disregarded, so far as the *public* are concerned. P. R. may well call this an appalling fact.

Many a fire in this metropolis and its

suburbs has been wholly unattended by any *public* fire-engine or fireman, and but for the exertions of the servants of the Insurance-Companies, whole streets would have been swept away in one common conflagration as of yore.

P. R. repeats a question to which he might as well take an answer from my last letter. If he is really a friend of Mr. Braithwaite's, and wishes well to his invention, he will cease to press the matter so pertinaciously. It is not for P. R., nor myself, to dictate the employment of such a machine; doubtless the parties to whom *we* think it would prove useless, will avail themselves of its aid so soon as *they are satisfied* of its *economy*, *superiority*, and *trustworthiness*.

I remain, Sir,

Yours respectfully,

WM. BADDELEY.

London, Dec. 27, 1836.

THE INSURANCE SYSTEM.

Sir,—Your correspondent, "Fire-Fury" (p. 227), if he had had his eyes about him, might have found a much more indigestible fact for Mr. Baddeley's mastication than that he has brought all the way from Manchester—and without going so far from home in search of it. In the very Number of the *Mechanics' Magazine* which was graced by his former letter (No. 696, p. 182) will be found a piece of evidence which throws much more light on the principles and practice of the Fire-Insurance Companies than a thousand such facts as those adduced by our friend with the terrific signature. I allude to the evidence of Mr. Walker, the eminent engineer, before the House of Lords' Committee on the danger from fire in the use of locomotive-engines in narrow streets. He tells us, that when employed as engineer to certain extensive water-works, one of whose objects was the better prevention of damage from fire, he waited on one or two of the Insurance-Companies, with the expectation that they would take particular interest in the matter, and he goes on to observe, "I was surprised to find the great indifference they had towards it, and I inquired how it was, and I remember one of the officers told me, *the truth was that they gave themselves little concern about it*, because it did not injure them; I said, 'How does it not injure you, have not you to pay the losses?' His reply was, that *if they had not fires occasionally, they should have no insurances.*"

Now, this broadly-stated fact certainly appears to be by no means corroborative of Mr. Baddeley's very decided opinion, that "every nerve has been strained" by the Insurance-Companies "to render the Fire-engine Establishment as effective as possible"—and to tally as little with his "answers from his own personal knowledge" of "YES" to Fire-Fury's question, "Whether the Companies desire a more effective instrument than the engine now in use?" In point of fact, this "nerve-straining" appears to be a very inconsistent piece of business, even on the view of the state of the case put forth by Mr. Baddeley himself, which is doubtless the correct one. How can it be expected that the Companies should "strain every nerve" to increase the means of protecting property, two-thirds of which (the uninsured proportion) belongs to parties who pay them nothing, whether it is burnt or not?

The matter seems plain and straightforward enough; and Mr. Baddeley and his adversaries are perhaps not so widely at variance as they imagine themselves to be. "The Insurance-Companies do not patronise the most effectual means of extinguishing fires," cry P. R. and Fire-Fury. Mr. Baddeley rejoins, indeed, that they *do*; but at the same time takes care to show the reason why they do *not*, and why it cannot be expected that they should do it; while Mr. Walker's evidence steps in by way of "clincher." It is quite obvious, that if preventive and other measures were carried to such a point of excellence that fires seldom occurred, and when they did occur were speedily put out, the inducement to insure would be very small. Now, this is the precise point at which it is the interest of the public to arrive; but can it be, for a moment, contended that it is also the interest of the Insurance-Companies? If the London Establishment were to adopt Mr. Braithwaite's steamer to-morrow, and it proved such a complete fire-eater as its advocates assert it to be, so that the moment a conflagration was discovered, it steamed itself off to the point of action, and forthwith destroyed every vestige of "the devouring element," what would be the natural effect? Why, that no *new* insurers would come

in, and most of the *old* insurers would back out! "A consummation devoutly to be wished," indeed, on the part of the Companies who had expended their thousands in encouraging invention whose success must needs involve their ruin!

This makes it clear that the matter really stands as P. R., in his original communication, supposed it to stand—to wit, "the Insurance-Companies *v.* the Public Security," inasmuch as if the public security were perfect, Insurance-Companies would cease to exist. Mr. Baddeley admitted as much in his reply, contending, very reasonably, that it was absurd to call on the Insurance-Companies to protect the whole of the property of "the public," when they were only paid for protecting, or rather for guaranteeing the restoration of one-third of its amount. Yet, with some degree of inconsistency, in his last letter he vouches for the desire of the Companies to procure the most effective means, and to "strain every nerve" to perfect the system of wholesale protection. How is this?

Fire-Fury and Co. deal very largely in threats of "public reprobation." But where is it to fall? On the Insurance-Companies? No; they conduct their "trade" in the way best calculated to bring in the most profit; *i. e.* they like a fire now and then, provided it does not burn too large a quantity of insured property, and make a great parade with firemen in melodramatic costume and most imposing helmets, while they throw cold water on any new scheme for putting out fires *too fast*, and with too little stage effect! It is "the public" that ought to meet with "public reprobation." It is to "the public" interest that the property of "the public" should be preserved; and if "the public" neglect to take the proper means of doing so, in the name of common sense, let "the public" bear all the obloquy.

Before I conclude, let me say a word on the analogous subject of "Marine Insurance." A Committee of the House of Commons, it appears, have promulged it as their opinion, that the system of ship-insuring is pernicious, because "the risk of loss can be covered by a fixed premium of insurance, which being charged on the freight, and re-charged on the goods conveyed, fixes the real loss and real responsibility ultimately on *the public*." What a discovery to be set forth in these politico-economical days! Do the Committee really mean to assert, that the price of goods is determined by the merchant, and that "the public" (poor soul!) puts his hand in his pocket, and pays whatever he chooses to demand? Do they actually think that the merchant and the ship-owner may settle what the amount of "freight" shall be betwixt them, and that the much-enduring "public" is forced to reimburse the merchant, whether he may choose to give one pound per ton or one thousand? If not, where is the point of their observation?

Whether the merchant imports his commodities in insured or uninsured ships, the price paid him by "the public" is the same; it is, therefore, his interest to reduce all the charges as much as possible, and he will hardly go to the expense of insurance if that expense is not required. Custom, indeed, may do a good deal, but it is too much to suppose that it should induce a merchant to pay a ship-owner an increased freight, in order that the ship-owner may pay a large sum for insurance to the underwriters; when all the while he might employ a vessel which would be certain to perform the voyage in safety, without any need of troubling the underwriting fraternity at all. But then, say the Committee, it is nothing to him; he charges it all on the public! If so, why not send a sound ship, and put the insurance-money into his own pocket?

I remain, Sir,
Your most obedient servant,
AQUARIUS.

Dec. 28, 1836.

AERIAL NAVIGATION—A SUGGESTION.

Sir,—The late bold aerial voyage of Messrs. Green, Holland, and Mason, will, in all probability, lead to attempts of still greater magnitude. From the suggestions of many, some improvements may ensue, which may perhaps facilitate the next great attempt. With much diffidence, I presume, through your journal, to suggest the following plan, which would, under some circumstances, enable the aeronants after descending to re-ascend and continue their route.

The ballast should in part consist of well-made recipients filled with condensed gas; to each recipient a well-made stop-cock should be attached, and which should be fitted to a cock connected

by an elastic tube to the balloon. By that method the gas discharged in the descent might, in some measure, be replenished. To recondense gas into the recipients from the balloon, would be more difficult, but not impossible; and I think a light and simple apparatus for that purpose might be constructed.* Could this be effected, the deserts of Africa might be crossed, as the winds are during certain seasons not variable. A country like Australia might be surveyed, and even the belt of the trade winds made a highway. To try the latter, a vessel might carry gas-recipients charged with condensed gas, and the balloon might proceed to a certain latitude where, either over the launch or on a raft prepared, the balloon might be inflated from the recipients as readily as in Vauxhall Gardens, and then left to the winds and the management of the aeronauts. The best gas-recipients I ever saw were made by a Mr. Bowser, not far from St. Katharine's Docks; as some time has elapsed since I saw them, there may be others lighter and sufficiently strong for the purpose. There is no difficulty in constructing tubes six inches diameter and three feet six in length, which weigh only nine pounds, and which I constantly use at three hundred pounds pressure of steam on the square inch, and which are quite safe at 1000. It would be premature to enter farther on this subject. If it is worthy of the aeronauts' attention, I can always be communicated with; and I will merely add, that it would give me pleasure to put the idea into practice.

Your obedient servant,

NATHANIEL OGLE.

Albion Club, St. James's-street,
Dec. 26, 1836.

ON CASTING AND GRINDING SPECULA.

(Continued from p. 219.)

Sir,—Referring to my last letter, I now proceed to describe the process of modelling the metal in the sand. The boxes or flasks should be similar to those used by brass-founders, excepting that the upper box should be deeper than the lower, as the former contains the metal and block. Fig. 1 represents a section of the boxes when ready for pouring;

Fig. 1.

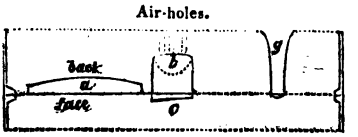


Fig. 2.

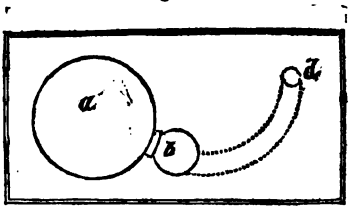
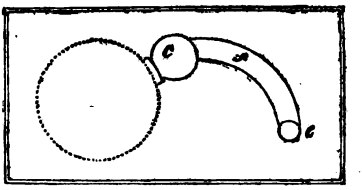


Fig. 3.



a, the metal; *b*, a large block of wood in the shape of a cone with its vertex removed, and also a small piece cut off one side by a perpendicular section. The use of the block *b* is to afford a reservoir or supply for the metal which contracts on becoming solid; and as the block from its size is always fluid some little time after the casting itself ceases to be so, it affords a supply to the latter and prevents its cracking or sinking on the back. So completely does it answer this purpose, that on removing it from the sand it is scarcely more than a shell; its section being similar to that marked out by the dotted line *b*. For this essential improvement in the art of casting, as, indeed, for many others connected with the subject, I am indebted to my friend Mr. Carnfield, late of Northampton. It is in vain to try to cast metals with only a small git, as they will invariably be found cracked when the boxes are opened. A piece of wood is to be modelled in the lower box, the size and shape of which will be understood by the two views of it given at *c*, figs. 1 and 3; *d*, fig. 2, represents the lower end of the git; *e*, fig. 3, a little well or indenture made in

* This has been repeatedly proposed; but I believe never tried.

the lower box to receive the first splash of metal in pouring; *f*, the channel or course for the metal from the git to the block, whence it flows into the mould for the mirror itself. The process of modelling is this: the patterns *a* and *b* are laid on a smooth board (the dimensions of which are something greater than those of the boxes,) in the situation shown in fig. 1, the flat side of the block next the mirror not touching it, and yet not more than one quarter of an inch from it. A piece of wood of the form *g*, fig. 1, should also be placed upright on the board, as in the figure, at least some inches distant from the block. Its length should be exactly equal to the depth of the upper box—this is for the git or pouring hole. The box is then to be filled with damp sand, such as the brass-founders use, and moderately rammed, sufficiently so to make it firm, but not too hard. The surface must be very even, and just the height of the edge of the box. A board similar to that under the box is now to be laid on the top, and the whole inverted. That board which is now uppermost is to be removed, and some dry ashes scattered through a fine sieve over the surface of the sand, keeping them as much as possible off the face of the pattern. Place the little pattern *c* exactly on the block, which will be more readily done if it have two pins standing out to fit corresponding holes in the block. This box is to be rammed exactly as the other; and when a board has been placed on the top, it is to be lifted off the first box, and set aside in an inverted state. With a little water moisten the edges of the sand round the patterns, and then carefully draw the block pattern with a gimblet; cut away a part of the small bit of sand between this and the metal, making the opening very little more than half the thickness of the metal; two-thirds the thickness may, however, be cut away with safety. Attention should be paid in ramming the first box to have the sand between the mirror and block pretty firm. Draw now the mirror pattern in the same way, and with a strong knitting-needle, make a few air-holes in the sand, which is above the top of the block, but make none elsewhere. The small pattern for the lower part of the block is now to be drawn from the lower box, and with a small modelling trowel, cut the course *f* in the sand, making the well *e* just under where the pouring hole will be. It may here be remarked, that instead of having to cut the channel and well, it will be better to have wooden patterns for them, by which method they will be formed more neatly, and with less trouble and danger. They are, if used, to be modelled in the lower box along with the pattern *c*. A little flour may be dusted over both sand surfaces, which will cause the metal to quit the sand more easily. The boxes are to be set on edge, and gently blown with a pair of bellows, to take away any loose grains of sand, and then carefully put together. A pair of wooden screws must be employed just to keep the sand in the upper box from rising by the column of metal; and some care is necessary, in order to restrain the sand from lifting without exerting any pressure downwards. The metal in the crucible should be stirred after taking from the furnace, and well skimmed, which should be done as quickly as convenient, that it may not get cool. It is difficult to give a correct idea of the proper degree of heat of the metal; it should be sufficient to render it *perfectly* fluid until the mould is just full, and any greater heat than this is hurtful. The boxes are to remain undisturbed after pouring until the top of the git *g* is become almost black, when a thin rod of iron may be put through the thin stratum of sand, which is over the block, to feel if it is become solid; if it is, it is then quite time to separate the boxes. The sand should be in part cut away, or carefully loosened from about the git and block, in order that the upper box may be lifted off without any danger of disturbing, and thereby warping the metal in its hot state. The mirror should be dull red when first exposed. At that part of the channel, which is about an inch from the block, lay a piece of rag soaked in cold water, which will cause it to break across, and thus separate it from the metal and block.

Previous to this period of the process, preparation must have been made for *annealing the metal*, which is absolutely essential to its safety; but as my letter is already sufficiently long, I shall leave the subject for my next,

WM. LASSELL, Jun.
18, Norton-street, Liverpool,
Dec. 17, 1836.

STANDARDS OF LINEAR MEASURE.

Sir,—The writer of the letter which appeared in your Magazine (No. 698) on a definite right line applicable to particular purposes in all countries, will not, I think, find any one inclined to dispute his assertion, that "much inconvenience does frequently arise" from the want of a universally adopted standard of measurement. It is questionable, however, if he will meet with such ready assent to the proposal which he brings forward for remedying the evil, namely, the formation of an entirely new arbitrary standard, to be brought into general use by the co-operation of a few leading societies of different states. There are already standards enough, and no occasion whatever for adding another to the number. The English or French foot, or yard, or fathom, or furlong—any and every measure will equally answer the purpose, provided only—there, alas! is the rub—that it be generally adopted.

That to effect this general adoption is no such easy matter as your correspondent appears to think is, in my opinion, clearly proved by the history of the French system of weights and measures, expressly contrived by a "leading Society" in France, for the general use of civilised nations; but which is so little known or thought of here, that your correspondent, though writing on a subject so closely connected, appears never to have heard of it. The invitation given by the French mathematicians appointed by the Institute to those of other nations to concur with them in establishing a scientific system of measurement, was not accepted; perhaps with some reason, for the French capital was not at that time the safest residence in the world for scientific characters, and the framers of the new system were so entirely scientific, that they contemplated a decimal division for every thing whatever, and could not allow even the seventh day to remain holy. This inclination, and their intention of dividing time and the geometrical circle into decimal parts, led them to select for the metre, or standard of linear measure, the ten-millionth part of the quarter of the circumference of the globe; a choice which proves that a "leading learned Society" will not always pursue the line of conduct dictated by common sense. The circumference of the globe cannot be considered as yet so accurately determined as to render it advisable to take it for a scale of measurement, nor is it probable that it ever will be; and the proportion of the new measure to the old ones, which was an object that ought not to have been lost sight of, was most unpleasantly fractional—one metre was equal to 3·079458 Paris feet. In fact, almost the only recommendation of the new scheme was its connexion with a decimal system of augmentation and subdivision. Ten metres, according to the table, made 1 decametre, 10 decametres 1 hectometre, 10 of the latter one kilometre, and 10 of those 1 myriametre, or 10,000 metres; while, on the descending scale, one-tenth of a metre was a decimetre, one-tenth of that a centimetre, and one-tenth of that a millimetre. Latin names were thus adopted for the descending, and Greek (bad Greek, by-the-bye) for the ascending scale; while, as Latin is more generally understood than the other language, and the ascending scale more frequently used than the descending, the reverse might have been considered more advisable if it were thought proper to compound the names from two languages at all; and even by that cumbrous means the risk of confusion is not avoided, as the words decimetre and decametre bear certainly too close a resemblance. However, in spite of all these objections, the new measure was adopted, and adopted with vigour too. A model of it in platina, as the most unchangeable metal, was constructed and deposited at the French Institute; others in metal, with marble casings, were built into the walls of the principal public buildings; on the great high-roads stones were erected at the distance of every kilometre; in short, every method was taken to bring it into use, and yet what has been the result? In France itself distances are still reckoned in the old French foot; in England it is not easy to point out any work, except a *Universal Combist*, which contains any information as to what the French weights and measures are, and in the recent alterations of our standards no attention has been paid to them.

Since there thus appears to be an insuperable *vis inertiæ*, or power of laziness, in existence to oppose the introduction of a standard merely brought for-

ward by scientific men, and not enforced by really practical use in the business of life, it is satisfactory to perceive that old Time will probably take the matter in hand, and in the course of another century give such a predominance to one of the existing systems as to render it familiar to all Christendom at least. The United States of America retain the English yard and the English mile, as well as the English language. By the year 1900, it is calculated that their population will amount to 100 millions, and it may surely be anticipated that under these circumstances our standard of measure will be used in every work, not only in English, but in any other language which aims at a general circulation; if, indeed, the same circumstances do not effect an analogous but still greater good by rendering English the general medium of communication of scientific facts. A great good will thus be conferred on the world, and a great honour on England.

I remain, Sir, yours, &c.

P. P. C. R.

Dec. 28, 1836.

REPLY TO MR. CHEVERTON'S OBSERVATIONS ON THE NEW THEORY OF PHYSICS. BY MR. EXLEY.

Sir,—The metaphysical disquisitions which have fallen into my hands, with a few honourable exceptions, have appeared to me nothing better than cobwebs to catch flies. If Mr. Cheverton will produce one plain argument, in a few words, to show that such as he states are the consequences of my theory, I should feel myself bound to analyse it; but when he asks a thousand questions, and makes a thousand suppositions with which I am no way concerned, he must excuse me if I not only run, as he observes, but gallop over them. After skimming a page or two of the Observations, and turning to the end, and seeing it was thirteen pages "to be continued," I shut the book, and said, I will wait to see the conclusion; and for the first time I read the observations last night, and this morning, and send you such remarks as I consider to bear on the point.

I thought I had laid down my two principles in manner so plain and clear that they could not be mistaken by a thinking man; and Mr. Cheverton thinks he has formed an impartial estimate of the theory: but I find he does not understand the two simple principles on which he criticises so copiously. This I gather from his questions, p. 423, especially these questions—"Are all bodies? are *any* bodies in contact?" Such questions can have no place in reference to this theory; any person paying attention to the first principle will see, at once, that the centre of every atom is not merely in contact with a surface, but is in the very substance of every other atom, which can exert on it any influence; and, after all that is said, common sense recoils at the idea of a body acting where it is not. Let any man believe, if he is able, that every atom which is entirely, and altogether confined within the surface of the sun, exerts an immediate action on the earth.

It seems, indeed, unaccountable to me, that a scholar so scientific, so candid, and so eminent as Sir J. Herschel, should make the assertion mentioned in page 420, without proof; but it was a hasty slip of his pen, to which all men are liable, but which seldom happens with that elegant and profound writer.

I still maintain, that my two principles are not arbitrary assumptions; and this is also shown in the abstract of the paper I read before the Chemical Section of the British Association, published in the *Records of General Science* for October last. The principles, themselves, are plain enough; but as to the gathering clouds of metaphysical questions, what is the nature of these atoms? Of this force? In what manner does it act? How does it lay hold on its subject? Has it a substratum, &c. &c.? I inquire nothing, I am not concerned here, I never dreamed of establishing my theory otherwise than as a physical one; and it does not give even the shadow of countenance to the consequences pretended to be drawn from it. I "concoct" no worlds, but reason from things just as I find them: and it was in this way I formed the theory. I wish Mr. Cheverton had thought a little before he asserted, "I have not spoken unadvisedly, but with a perfect knowledge both of what I meant and what I *said*." I wish he had taken care to have a perfect know-

ledge of my two principles stated in plain English language.

Mr. Cheverton still contends, that I introduce subsidiary hypothesis, and that I say a thing is so "because the fact requires it, and because the prior subsidiary hypothesis will not hold good without it." He should have said, because the fact requires it, and the two principles allow it; but to refute this he thinks "it is quite enough to say, that for aught we can tell, the circumstances may *not* be such, &c." It is admitted, at once, that the theory does not make it necessary that there should be such atoms as constitute iron, cobalt, or nickel, or, indeed, any other particular substance; but it allows they may be, and when fact shows they are, principle and fact go together. Magnetical facts, in general, shew that the spiral channelled course of the ethereal matter, and electric fluid, or something equivalent to it, really exists; and the theory provides for such cases and circumstances; but that they really exist does not depend on the theory, but on the good will of the Supreme Creator. If this is mere hypothesis, just as well may it be said, that the evaporation of water, its condensation, and falling on the earth in rain is mere hypothesis. On the principle of gravitation this process is possible, yet not necessary; but phenomena prove this circulation of water from a visible to an invisible, and back to a visible form. But now comes the appalling fact of magnetism produced on a plate of hardened steel in fine lines, on which the angular point of a bar magnet had been drawn. My former explanation does not satisfy; he now dwells on the fineness of the line as an insuperable objection to my way of explaining magnetism. A little thought would have prevented this misconception; so far from being communicated in a broad space of the plate, consistency with all my explanations, not only admits, but absolutely requires, that the magnetism should be in fine lines along which the corner of the magnet is drawn; for the ethereal matter flowing round the magnet, and passing on, or off, at the point of contact with the plate, would, according to all the previous explanations, penetrate only to a small depth and breadth around the line marked: had it extended to a great breadth, so far from favouring, it would have strongly militated against the theory; the harder the plate the finer the lines ought to be, as I conclude from theory, though I have not made the experiment.

Mr. Cheverton now enters the slippery ground of metaphysics, but having no pleasure in sporting on ice, I shall not long tarry on its surface. We hear, at once, of inquiries into recondite speculations which "will show the possibility of connecting the ultimate researches in natural philosophy with the first steps in mental philosophy, and the practicability of inducting from the phenomena of matter to the phenomena of mind," p. 425. If he can show the connexion between matter and mind I have no objection; but with this, my theory is in no way concerned: whoever will attentively consider the two first principles, and, at the same time, contemplate the phenomena of mind, will see that they have nothing in common. What has material force, force considered simply as in these principles, to do with thinking, judging, feeling, desiring, or willing?

Force, as the term is used in the postulates, is not defined, as to its intrinsic nature, but only in relation to its laws and quantities, as shown and measured by physical phenomena; and if there be four or four hundred doctrines about essences, connexions of mind and matter, &c., it is nothing to me; none of them can be inferred from the doctrines advanced in my theory.

I do not deny that there are solid atoms, provided they be as small as we please, nor do I contend, much less decide, about a substratum, but give it simply as a matter of opinion, which I hold, but on which I build nothing. That there are no solid atoms, and that no substratum is required—whether this is right or wrong—is of no consequence to my theory; it is quite a distinct consideration upon which those who have nothing else to do may spend their time and powers. I am not versed in metaphysics, and confess those fine-spun speculations never had any charms for me; what I intended to denote by the expressions, the essence of matter, its essential nature, that force constitutes its nature, &c., I expected to be understood in no other way than as

matter was delineated in the two postulates, and not its absolute or intrinsic nature: if from my ignorance of metaphysics, I have not used the proper terms, I must beg the indulgence of those gentlemen who can adopt their language, even to the splitting of a hair; but an impartial critic would have interpreted my language according to my express declaration, when speaking of this force, "We cannot tell what is essential nature." New Theory, p. 470. In saying matter is perceptible by its powers acting on the senses, I did not intend to express any action on the mind, but on the organs of sense; this is as far as my theory goes—what lies deeper than this I leave to others.

Mr. Cheverton cannot understand how power or force can be a substance, nor can I, or any body else, unless we are told what power or force is. Till this is done nothing more than mere opinion can be formed on the subject, and it is nonsense to talk about deciding whether it is a substance or a property till we know what it is: as for myself I know nothing of it but from its effects. From these I formed my opinion, as such and nothing more, that it is a substance; but on this I decide not, and on it build nothing whatever, and from it draw no consequences, and it would be vain to do so. Hence, while metaphysicians are spinning their slender threads in the regions of fancy, we take our stand on the firm platform of inflexible facts, which furnish us with a sure path to the two postulates, which describe matter as to its laws and quantities, leaving the metaphysicians to disprove it if they can.

When I said respecting the force in question, considered as a substance, that of course it is a material substance, I meant no more than that it produces the phenomena attributed to the action of matter, be that what it may: whatever it is, it produces the effects which we measure and estimate, and view as the actions of matter; but how they are viewed or perceived by the mind I cannot tell, and do not pretend to say; and, notwithstanding the questions and twistings on page 428, I still stick to my text, and two first principles stated in plain English, and, as I think, easily to be understood by any thinking person, not warped by metaphysical subtilities, or searching after enigmas: most assuredly my principles are more simple and easy to be comprehended than those either of Newton or Boscovich, and quite as free from mystery, while they coincide with both, without a shade of difference, as far as they carried the principle of gravitation.

I do not feel myself concerned about the queer, crooked, crabbed questions and the suppositions in p. 428 and 429; if Mr. Cheverton can prove that solid atoms exist, he shall have my thanks; but as things now stand in philosophy, it is no hypothesis to say that the force of gravitation exists, though it is mere hypothesis to say that solid atoms exist.

We now gallop on to the observations in the October Number, on which I remark, that it remains to be proved whether these little solids make vivid impressions, &c., because it remains to be proved even whether they exist or not. It is preposterous to say that, because we know matter only by its effects; and, in like manner, we know spirit only by its effects, we destroy all distinctions between them, while the effects by which we know them have nothing in common; it is folly to waste time on unknowables: volition, it is allowed, implies action and force, and perhaps some kind of motion; but this action and force and motion cannot be substituted for, nay, cannot be compared with the action and force and motion concerned in my postulates: put them together and look at them; how very heterogeneous! What follows in the remainder of the observations, have already received their answer as being unconnected with my theory, which rests on a firm rock not easily to be shaken.

THOMAS EXLEY.

Bristol, Dec. 20, 1836.

PRODUCTION OF INSECTS BY GALVANISM.

(From the *Somerset County Gazette.*)

We feel much pleasure in communicating to our readers the following singular experiment of our now celebrated neighbour, Mr. Andrew Crosse.

The public are aware that Mr. Crosse has been recently pursuing a series of researches into the process of crystallisation by means of his galvanic batteries, and that he has made discoveries which have thrown quite a new light upon science. Some weeks ago he

prepared a silicious fluid for the purpose of crystallisation. He heated a flint to a white heat, and then plunged it in water to pulverise it. The silex, thus reduced, was saturated to excess with muriatic acid. The mixture was placed in a jar—a piece of flannel was suspended in it, one end of which extended over the side, and thus, by capillary attraction, the liquor was slowly filtered, fell into a funnel, and thence dropped on a piece of iron-stone from Mount Vesuvius, upon which were laid the two wires connected with either pole of the battery. We should state that the ironstone had been previously heated to a white heat, so that no germs of life could have existed upon it. Mr. Crosse made his daily observations of the wires to discover the beginning of the process of crystallisation. On the 14th day he saw some small white specks upon the stone. Four days afterwards they had elongated, and assumed an oval form. He concluded that they were incipient crystals. Great was his surprise on the 22d day to find eight legs projecting from each of these white bodies; still he could not believe that they were living beings. But on the 26th day his surprise was complete; there could be no doubt they moved, they fed, they were perfect insects. 18 or 20 of them have since appeared. Many persons have seen them, but there is no record of such an insect.

It is in form something like a mite. It has eight legs, four bristles at the tail, and the edges of the body are very bristly. Its motions are visible to the naked eye—its colour is gray—its substance is pulpy. It appears to feed upon the silicious particles in the fluid.

The most extraordinary circumstance in this phenomenon is the nature of the fluid in which this insect lives and thrives. The acid instantly destroys every other living being.

But a second trial has confirmed the fact beyond a doubt. Another portion of silex was prepared in the same manner, and reduced to a gelatinous form, but without the acid. A coil of silver wire was suspended in it from one of the poles of the battery, and the other pole was also immersed, so as to send through the mass an incessant stream of the electric fluid. About three weeks afterwards Mr. Crosse examined the poles to search for crystals, and in one of the coils of wire he found one of these strange insects. This proves that it is produced from the silex and not from the acid.

Mr. Crosse, with his usual modesty, has contented himself with stating the fact, without attempting to account for it. He is in correspondence with Professor Buckland upon the subject, and the learned professor has suggested an explanation, which it will be for future observers, by repeated experiments, to confirm. We should state, that the insects were principally found at the negative pole of the battery.

A German naturalist has recently discovered that silicious and other rocks are chiefly composed of the remains of insects. May not the germs of some of them, released from their prison-house, and placed in a position favourable to the development of vitality, have sprung to life after a sleep of thousands of years?

NOTES AND NOTICES.

Gratuitous Lecturing.—In a series of Resolutions just adopted by the Gresham Lecturers to express their very resolute resolution not to move, it is stated, that during the past year the number of their auditors has amounted to 1900, and that the average number of persons who have attended the most popular series, the Astronomical, has been 64, which leaves 18 for each of the rest. This number appears any thing but satisfactory, in a capital where five or six hundred persons are often found willing to *purchase* the privilege of hearing a lecture on the very subjects in which the Gresham establishment proffers instruction gratis. But strange as it may seem, in Paris itself, the very metropolis of accommodation of this kind, where the most eminent scientific characters of the country deliver lectures with the doors open to all who choose to enter, the results do not present a very striking contrast. An intelligent German traveller, Benzenberg, who visited Paris in 1804, and published an account of his observations next year, at Dortmund, resumed, on his arrival there, his "University Life," which is, he tells us in his opinion, "always and every where the happiest form into which life can shape itself," attended the most attracting lectures then delivering in the French capital. He was not only astonished at the military aspect of the lecture-rooms, in which a couple of soldiers always appeared, immoveable as a couple of statues, one on each side of the lecturer, but at the small number of persons gathered together to share a treat which was so attractive to himself. At a lecture of Lalande's, at the college of France, he found only six auditors. Those of Hany and Fourcroy were the most popular by far, and at Hauy's he made the hundredth who attended; while at Fourcroy's he never on any occasion counted more than 112. Yet he is confirmed by Meyer (another German writer whose letters were, we believe, translated into English), in estimating Foureroy as a consummately eloquent and interesting speaker, as well as a man of genuine science. The Swedish traveller, Suedenstjerna, who visited Paris much about the same time, is also loud in his praise of Fourcroy, whose talents in lecturing he considered it impossible to surpass, till a few months after he heard Sir Humphrey Davy, who had just then burst into the full blaze of his fame, at the Royal Institution. It is well known that these lectures of Sir Humphrey's, to which access was difficult, were attended by eager crowds.

The assertion of Sir Humphrey Davy, that no species of plant will vegetate downwards, has lately been contradicted by an experiment made by Messrs. Lockhart and Co., florists, Cheapside, in a Narcissus, the bulb of which is placed in a large glass vase filled with water. The Narcissus is now on the point of coming into flower downwards, a large pod of bloom and several long leaves being already visible in the water.

Lighting Houses by Electricity.—Professor Meinecke, of Halle, proposes to light houses and streets by means of an electric spark, and he thinks that

this system may supersede that of gas, as giving a better light, and being more economical. His plan is to construct luminous tubes, having at intervals metallic plates, on which might be formed, by means of a machine, a rapid succession of electric sparks. The Professor has obtained by an operation of this kind, and from a two-feet machine, a constant light in his apartment resembling a bright moonlight. By confining the sparks in a tube filled with rarefied hydrogen-gas, the Professor thinks it will be easy to obtain the same result on a large scale.

Analysis of Woods.—Two German chemists, Messrs. Petersen and Schodler, have made elaborate experiments in order to ascertain the quantities of carbon, hydrogen, and oxygen contained in each species of wood. They have analysed 24 different kinds, and after having dried them and reduced them to powder, have taken 100 parts of each in weight, and found that the quantity of carbon in each does not vary more than from 48 to 50 per cent, the hydrogen from 5 and 1-3d to nearly 6 per cent., and the oxygen from 43 and 1-3d to 45½ per cent. The proportions would be different in relation to volume; for instance, a cubic metre of oak weighs 479lbs., while the same body of poplar weighs only 221 lbs.

French Mechanics' Institute.—A Society has been formed at Paris (says the *Literary Gazette*) on the plan of the London Mechanics' Institution. It was first suggested by the celebrated geometrician, Monge, and the labour of instruction is principally confided to the students of the Polytechnic School. Classes are organised to teach the principles of mathematics, optics, and all the branches of natural philosophy; as also the fine arts, grammar, and languages; each class is presided over by an advanced member; and the plan is so successful, that the Society musters at the present time upwards of 1500 members. We hope the Parisian mechanics will be more fortunate in their Institution than have been the London. The tutorship of the Polytechnic scholars seems to be the most objectionable part of this scheme; we do not say this in order to detract from the merits of these youths—but from our often-expressed opinion, that such Institutions can never answer the desired end unless the members proceed upon the independent principle of themselves paying for the benefits they receive. Government direction will, no doubt, be thrust upon the Society—in France this cannot be avoided—but of individual patronage or aid we warn the Parisian Mechanics to beware—keeping the example of the London Institution before their eyes, which, from one of the most promising schemes for bettering the condition of the working mechanic, has degenerated into a mongrel concern, without any definite aim or character.

Institution for Disabled Colliers and Miners.—A correspondent of the *Staffordshire Advertiser* suggests the formation of a fund for the relief of disabled colliers and miners. The following is his plan:—"1. Let an Institution (suppose we name it 'The Miners' Friend') be formed for the whole kingdom, with a general hospital, in some mining district, attached, for the permanent reception of a certain number and kind of disabled and destitute colliers or miners, who are members.—2. Let it be supported by the benefactions of the wealthy and charitable, and the annual subscriptions of mine owners and their workmen.—3. Let temporary or permanent relief be given to those members only who receive bodily injury, or are disabled, in mining concerns, with life-annuities to the families or dependents on such as lose their lives in the pursuit of their callings in mines.—4. Let all owners, masters, and workmen, of mining concerns in the United Kingdom, be invited to become members; the workmen to pay a small sum each quarterly, and the proprietors and public to pay collectively as much, or perhaps twice as much, as the workmen pay collectively; thus laying the burden on the public, the proprietary, and the party to be benefited.—I deem it impolitic to free the workmen altogether from charge, as it is imprudent to help those who will not help themselves; and a few shillings a year from each man (judging from the casualties in my own concerns for twenty years past) added to other resources would, I think, sufficiently support the Institution. If we look narrowly into the present importance of collieries and mining concerns, with a view to the protection and prosperity they afford to Old England, we shall find them on the one hand, what brave seamen and wooden walls are on the other; and as the sailors have their refuge at Greenwich, let not the colliers be without retreat when disabled in such laudable and beneficial service."

Trial of the New Fire-proof Dress.—At a fire (not a serious one) which occurred lately at Mr. Knight's, stationer, Basing-lane, Watling-street, the Parisian smoke-proof fire-dress was, for the first time, brought into actual service. Mr. Braidwood himself put it on, and, descending into the cellar, there remained till the fire was completely extinguished, passing through the parts where the smoke was most dense without experiencing any inconvenience. The firemen who were not so equipped were not able to remain in any part of the cellar more than ten minutes, and experienced a difficulty of breathing, and their eyes were red and swollen, as if they had been crying. There were two engines brought to the spot, one of which was employed in supplying Mr. Braidwood with a continuous current of fresh air. The flames never mounted above three feet from the floor, nor was the smoke particularly dense, so that the apparatus cannot be said to have been fully tested on this occasion; but enough was done to confirm Mr. Braidwood in the opinion former experiments had induced him to form of its great utility in the case of fires in cellars.

The Supplement to Vol. XXV., containing Title, Table of Contents, Index, and Plate of Specimens of English Medallic Engraving by Mr. Bate was published on the 1st of December, price 6d.

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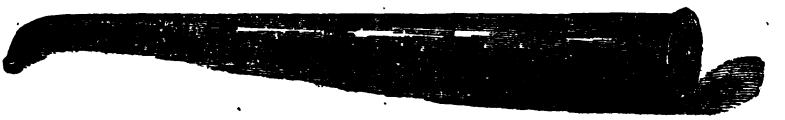
MR. CURTIS'S ACOUSTIC CHAIR.

AND TELESCOPE HEARING-TRUMPET.



MR. CURTIS'S ACOUSTIC INVENTIONS.

The application of acoustics to the purposes of civilisation has been very culpably neglected—even to the loss of what was known and practised centuries ago. Dr. Reid has had the merit of calling public attention to the subject, in as far as relates to the construction of buildings, in his public lectures and his evidence before the Commons' Committee on the New Houses of Parliament.* We have now to call the attention of our readers to another branch of the science, namely, the conveyance of sound to great distances by acoustic tunnels. "What the telescope is to the eye, acoustic tunnels would be to the ear. It appears no more wonderful that we should be able to *hear* at the distance of five or six miles, than that we should be enabled to *see* objects at that distance by the telescope, as distinctly as if we were within a few yards of them."† Acting on this intelligent view of the subject, Mr. Curtis, one of the most skilful aurists of the day, has been led to the invention of an acoustic chair, of which an engraving appears on our front page, and which is thus described in his "Treatise on the Ear."‡

"The acoustic chair is intended for the benefit and use of the incurable deaf. A somewhat similar chair was constructed in 1706 by M. Duguet, who likewise invented some acoustic tubes. But one of the great advantages possessed by my chair over his consists in this, that the person sitting in it hears at the opposite side from that at which he is addressed; thus avoiding the unpleasant and injurious practice of the speaker coming so close as to render his breath offensive, and, at the same time, detrimental to the organ of hearing, by causing a relaxation of the membrane of the tympanum. This is an effect commonly produced by the use of short flexible tubes,§ no less than by hearing-trumpets, which latter are as often, perhaps, employed for speaking through, as for the purpose for which they were designed; and it is a certain fact, that many persons, after having used a trumpet for half-an-hour, are quite deaf, from the action of the breath impelled against the membrana tympani.

"My acoustic chair is so constructed, that, by means of additional tubes, &c., the person seated in it may hear distinctly, while sitting perfectly at ease, whatever transpires in any apartment from which the pipes are carried to the chair; being an improved application of the principles of the speaking-pipes now in general use. This invention is further valuable, and superior to all other similar contrivances, as it requires no trouble or skill in the use of it; and is so perfectly simple in its application, that a child may employ it with as much facility, and as effectually, as an adult. It is, moreover, a very comfortable and elegant piece of furniture.

"This chair is of the size of a large library one, and has a high back, to which are affixed two barrels for sound, so constructed as not to appear unsightly, and at the extremity of each barrel is a perforated plate, which collects sound into a paraboloid vase from any part of the room. The instrument thus contrived gathers sound, and impresses it more sensibly by giving to it a small quantity of air. The convex end of the vase serves to reflect the voice, and renders it more distinct. Further, the air enclosed in the tube being also excited by the voice, communicates its action to the ear, which thus receives a stronger impression from the articulated voice, or indeed from any other sound. What first induced me to invent this chair was the fatigue I sometimes experienced in talking to deaf persons.

"By means of sufficient tubes, this chair might be made to convey intelligence from St. James's to the Houses of Lords and Commons, and even from London to the King at Windsor. Marvellous as this may seem, the idea is not a novelty; it is but another confirmation of the saying of Solomon, that there is nothing new under the sun. M. Itard, in his excellent work on the ear, tells us that Aristotle (who was physician to Alexander the Great) invented a trumpet for his master, which was capable of conveying orders to his generals at the distance of 100 stadia, equal to rather more than 12 miles.‖ And I may remark, bearing in mind, too,

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* See *Mechanics' Magazine*, vol. xxv. p. 69.

† "Dick's Christian Philosopher."

‡ A Treatise on the Physiology and Pathology of the Ear. By John Harrison Curtis, Esq., Aurist to his Majesty, &c. Sixth Edition. London: Longman and Co.

§ "Instances are on record in which very baneful and injurious effects have resulted from the practice of speaking *into* the ear, more especially where the breath of the person is tainted. One case I may mention, which is related by Lord Herbert. Cardinal Wolsey, he tells us, towards the latter part of his life, was in the habit of whispering into the ear of his sovereign, Henry VIII.; and the serious indisposition of the king has been many times attributed to this cause, and certainly not without reason.

‖ "This is mentioned in a MS. found some time since in the Vatican, entitled *Secreta Aristotelis ad Alexandrum Magnum*, and is stated to have been five cubits in diameter. Sir John Morland's speaking-trumpet only conveyed sound on the open sea for a distance of two miles, even when the wind was favourable.

that both Alcmeon and Hippocrates are said to have invented ear-trumpets, 'that the ancients do not seem to have been so ignorant of acoustics as some in our day have represented them.'"

In the engraving, A is the acoustic barrel, B the acoustic conductor, C the tube to be applied to the ear, and D the tunnel by which the sound is to be conveyed. This chair is only shown adapted for hearing; to convey sound from it to a distance, there should be another conductor, and a mouth-piece to speak through.

We understand that Mr. Curtis has at present before the Lords of the Treasury a plan for conveying messages from one Government-office to another, upon the same principle as the chair; as, for instance, between the various official departments in Whitehall, from the House Guards to the Mansion House, &c.

In the work which we before quoted (the "Christian Philosopher,") are some very interesting remarks upon the subject, which we subjoin:—

"'Some experiments have lately (1828) been made by M. Biot, 'on the transmission of sound through solid bodies, and through air, in very long tubes.' These experiments were made by means of long cylindrical pipes, which were constructed for conduits and aqueducts, to embellish the city of Paris. The pipes by which he wished to ascertain at what distance sounds are audible, were 1,039 yards, or nearly five furlongs, in length. M. Biot was stationed at the one end of this series of pipes, and Mr. Martin, a gentleman who assisted in the experiments, at the other. They heard the lowest voice, so as perfectly to distinguish the words, and to keep up a conversation on all the subjects of the experiments. 'I wished,' says M. Biot, 'to determine the point at which the human voice ceases to be audible, but could not accomplish it: words spoken as low as when we whisper a secret in another's ear, were heard and understood; so that not to be heard, there was but one resource, that of not speaking at all. This mode of conversing with an invisible neighbour, is so singular, that we cannot help being surprised, even though acquainted with the cause. Between a question and answer, the interval was not greater than was necessary for the transmission of sound. For Mr. Martin and me, at the distance of 1,039 yards, this time, was about 5½ seconds.' Reports of a pistol fired at one end, occasioned a considerable explosion at the other. The air was driven out of the pipe with sufficient force to give the hand a smart blow, to drive light substances out of it to the distance of half a yard, and to extinguish a candle, though it was 1,039 yards distant from the place where the pistol was fired. A detailed account of these experiments may be seen in *Nicholson's Phil. Jour.*, for October, 1811. Don Gautier, the inventor of the Telegraph, suggested also the method of conveying articulate sounds to a great distance. He proposed to build horizontal tunnels, widening at the remoter extremity, and found that at the distance of 400 fathoms, or nearly half a mile, the ticking of a watch could be heard far better than close to the ear. He calculated that a series of such tunnels would convey a message 900 miles in an hour.

"From the experiments now stated, it appears highly probable, that sounds may be conveyed to an indefinite distance. If one man can converse with another at the distance of nearly three quarters of a mile, *by means of the softest whisper*, there is every reason to believe, that they could hold a conversation at the distance of thirty or forty miles, provided the requisite tunnels were constructed for this purpose. The latter case does not appear more wonderful than the former. Were this point fully determined, by experiments conducted on a more extensive scale, a variety of interesting effects would follow, from a practical application of the results. A person at one end of a large city, at an appointed hour, might communicate a message, or hold a conversation with his friend, at another; friends in neighbouring, or even in distant towns, might hold an occasional correspondence by articulate sounds, and recognise each other's identity by their tones of voice. In the case of sickness, accident, or death, intelligence could thus be instantly communicated, and the tender sympathy of friends immediately exchanged. A clergyman sitting in his own room in Edinburgh, were it at any time expedient, might address a congregation in Musselburgh or Dalkeith, or even in Glasgow. He might preach the same sermon to his own church, and the next hour to an assembly at forty miles distant. And surely there could be no valid objection to trying the effect of an *invisible preacher* on a Christian audience. On similar principles, an apparatus might be constructed for augmenting the strength of the human voice, so as to make it extend its force to an assembled multitude composed of fifty or a hundred thousand individuals. In short, intelligence respecting every important discovery, occurrence, and event, might thus be communicated, through the extent of a whole kingdom, within the space of an hour after it had taken place."

Mr. Curtis has also invented various

instruments for the relief of the deaf. His telescope hearing-trumpet (see front page), forming a parabolic conoid, and shutting up into a small case for the pocket, is one of the most useful.

STEAM COMMUNICATION WITH INDIA.

Two years and a half have now elapsed since a Committee of the House of Commons recommended the immediate establishment of a line of steam-packets between England and India, by way of the Red Sea—and yet that object is as far as ever from being carried into effect. It was, as the event has shown, a most unfortunate circumstance that the same Committee also recommended the fitting out of an expedition to attempt a passage by the river Euphrates and the Persian Gulf, since the very activity and spirit with which that expedition was set on foot, seem to have exercised a benumbing influence on the less romantic but more certain plan; and the public mind appears to have been too much occupied with one expedition to India, to be able to take any interest in the furtherance of another. The Committee made another mistake; they recommended the House of Commons to grant 20,000*l.* in aid of the Euphrates enterprise—the House at once voted that sum—and Colonel Chesney was quickly on his way to the East; they also declared that a regular line of steam communication by way of the Red Sea ought forthwith to be established, at the joint charge of the Government and the East India Company, and left it to those two bodies to consider the details of the plan. What is the result? There has been plenty of time, and to spare, for a score of voyages, and *nothing has been done*. It would evidently have been far better had the House of Commons found the funds for setting the practicable scheme afloat, and referred the Euphrates, or merely experimental part of the business, to the long-winded "consideration" of the Ministry and the lords of Leadenhall-street.

Now, however, that the Colonel's expedition has proved a total failure, it is devoutly to be hoped that the rational and straightforward half of the Committee's recommendation will be attended to. It is nothing short of a disgrace to England that a regular communication with its dependencies in Hindostan by the agency of steam is a thing still to seek; the delay which has taken place in effecting it is, indeed, absolutely astonishing. If public attention at home could be properly directed towards the importance and the practicability of the object, there is reason to hope that whatever difficulties stand in the way would quickly disappear. A few public meetings in the metropolis, and the leading commercial towns, are probably all that is required to overcome the *vis inertiæ* of the "powers that be," and give a due degree of life and vigour to the long-dormant recommendation of the Commons' Committee. There is, at any rate, no want of enthusiasm at the other end of the Line; all India, British and native, may be fairly said to be unanimously in favour of the question, and the three presidencies have testified the sincerity of their feelings by subscribing largely to promote the object. Petitions to Parliament from that quarter are also ready for presentation at the opening of the ensuing session; and these would, of course, *tell* with redoubled effect if followed by others with a similar prayer from the leading cities and towns of "the home empire." To excite such a manifestation of opinion appears to be one of the chief objects of a well-timed pamphlet recently published, from the pen of Captain Grindlay, the London Agent to the Steam Committees of Calcutta and Madras;* which is also valuable in another point of view, as presenting in a collected form all the facts relating to what has been done and is doing in furtherance of the grand design. It is to be hoped that the Captain will succeed in arousing the attention of the public towards it, of which there is little doubt, if he be backed, as he ought, by the periodical press.

Whether Government and the East India Company have ever given that consideration to the scheme which they were recommended to do by the Parliamentary Committee, cannot, of course, be known. If they have, the grand obstacle to their immediate adoption of the plan must have been the expense. It is admitted

* A View of the Present State of the Question as to Steam Communication with India; with a Map, and an Appendix, containing the Petitions to Parliament, and other Documents. By Captain Melville Grindlay. London: Smith, Elder, and Co. 1837. 8vo. pp. 99.

on all hands, that the returns to be looked for from passengers and postage will not equal the expenditure; and it is, therefore, a question of some interest to the parties on whom the burthen is to fall, what sum may be reasonably anticipated as the amount of the deficiency? In the appendix to the Madras memorial to the India Company a detailed estimate is entered into, from which it would appear that the estimates formerly made by the Company might (as suspected by the Commons' Committee) be greatly reduced in almost every particular; to so great an extent, in fact, as to diminish the probable charge on the Indian revenue to a fraction above 10,000*l.* per annum—a sum too small, it might well be supposed, to weigh long in the balance against a scheme whose advantages, immediate and prospective, are so immense, that, in the words of the late Governor-General, Lord William Bentinck, "they would be cheaply bought at any price." It is to be lamented that the estimate put forth by the newly-started East India Steam Navigation Company should, in appearance at least, be so much at variance with this. The Company propose to effect a regular monthly communication with India, by the Red Sea route, on a sum of 65,000*l.* per annum being guaranteed to them; so that, at first sight, the Madras estimate, according to which the whole sum out of pocket would be little more than 20,000*l.*, seems extravagantly low. It should be borne in mind, however, that the Madras Committee enter into the details of their estimate, which the Company do not—as well as that the latter include in theirs the expenses of the whole line, while the former confine their attention to the Indian half, to which alone the resolution of the Committee as to the division of expense refers, the line to Alexandria being already established by Government, and proposed to be left in their hands; a fact apparently quite overlooked by the projectors of the new Company, although by no means without its importance.

The setting-up of this Company at the present juncture is perhaps a thing to be deprecated. Division has been the bane of the steam-communication project from the first. In India the rivalry of Bombay with the other presidencies, as a point of starting, has only been productive of an evil effect; and at home we have seen what has been the result of the House of Commons' Committees aiming at two things at once. What is now wanted is unanimity—"a long pull, a strong pull, and a pull altogether." The selection of Point-de-Galle, in the island of Ceylon, as a point of union, from which branch steamers may proceed, on the arrival of the mail, respectively to Calcutta, Madras, and Bombay, is likely to reconcile jarring interests in India; and, now that the Euphrates expedition is at an end, and the long line by the Cape is well nigh given up by its former supporters, at least as a medium of rapid conveyance, it would be most desirable to unite all the friends of steam communication at home, in one simultaneous effort. To have half a dozen different projects on the anvil at once, each with its little band of exclusive supporters, instead of one plan, with all these separate parties combined in its favour, is unhappily the ready way to frustrate the object of all, instead of advancing it.

There is one circumstance connected with the proposed line by the Red Sea which is so often misconceived, that it can never be too often adverted to. In the appendix to Captain Grindlay's pamphlet a quotation is given from the letter of a Manchester manufacturer, in which the writer takes it for granted throughout that the aim of the promoters of the plan is to restore the commerce of the East to its ancient channel. It is no such thing. There are a thousand reasons why this would not be practicable if it were desirable, nor desirable if it were practicable. It is only proposed to make use of the shorter, or north-eastern passage, as it has been called, for the conveyance of despatches, letters, and passengers, so as to keep up a much quicker communication with the Eastern dependencies, than can be effected by the far superior mercantile line of the Cape of Good Hope. It is likely to be long enough ere the raw cotton of Hindostan, or the manufactured calicoes of Manchester, are transmitted or re-transmitted by way of the Isthmus of Suez; at any rate, no such thing is contemplated *at present*, and it is, therefore, quite a mistake for the "Manufacturer" to argue upon the supposition that it is a "fundamental feature" of the plan.

ON THE PROGRESS OF VEGETATION UNDER THE INFLUENCE OF VAPOURS.

Sir,—I am not aware that writers on vegetable physiology have directed their attention to the respective effects produced by the several elements upon the system of vegetation; and yet it is evident that since their properties differ so essentially, their modes of operation with its results must also differ materially. When we contemplate the commencement and progress of a plant from its seed, or of a new shoot from an unopened bud to a full-grown branch, we observe two marked changes which it undergoes before its arrival at maturity. To instance, in the most common and useful of grains, how different is the shooting blade from the seed whence it issued, and the formed ear from either of its preceding states; the opening leaf which issues from the bud, and the full-grown branch, with its expanded leaves and fruits, proceeding from its numerous and extended ramifications, in like manner, differ as essentially from their source and from each other. Now each of these states or stages of vegetation appears to be peculiarly adapted to a corresponding element, while it is in some degree fitted to be acted upon by either or all of them. If the bud is exactly fitted by its form, situation, and rigid texture, to receive an electrical excitement from the winds; the opening germ with its shooting leaves seems no less peculiarly suited to the action of vapours. In like manner, the full spread leaf is as manifestly adapted to the refining action of the solar beams upon its liquid contents. We shall now direct our attention to the second of these processes, or the mutual action of the opening leaf and the condensing vapour upon each other.

No sooner has germination commenced than an increased supply, both of nutrition and of the principle of vitality, is required. If a dry atmosphere was requisite to the former process, one charged with vapours appears now to be as essentially requisite. The long acute points, the sharp and serrated edges, the extended surface, abounding in capillary filaments of the shooting leaf, are exactly adapted for acting electrically upon the vapours as they approach in a gradually condensing state. Its lithe movements, yielding to every breeze, enables it as it were to explore the atmosphere in search of every vapour within its vicinity. By this means it co-operates with the condensing agency of cold by imbibing a portion of the subtile fluid which holds water in the vaporous state, and causing it to settle upon its surface in the liquid form, for the reception of which its numerous pores are prepared. It was remarked, p. 540 of your last volume, that "in uncultivated countries the weather is mostly in the extremes;" that rain when it comes takes the form of an overwhelming flood, and is quickly followed by a burning heat which destroys the coarse and scanty vegetation which the rain has fostered, &c. These extremes are probably averted in part by this action of the leaves upon vapours where vegetation is sufficiently abundant. In its absence a low temperature is the sole cause of the conversion of vapours to the liquid state, which must take place suddenly when the cold has reached a certain degree, and their whole contents being discharged on the soil, must fall in torrents. Their caloric of vapour being diffused wholly in the atmosphere, must cause a sudden great increase of heat and rarefaction, in proportion as it enters into combination with the particles of air; and, in proportion, as it remains uncombined, must float in an electrical state, tending to produce convulsions. When, on the other hand, a due supply of luxuriant plants occupy the earth's surface, and extend their foliage through the atmosphere, their attractive influence seizes the vapours at a much higher temperature, imbibes a large portion of their subtile fluid in the form of electricity into their substance, and causes a corresponding portion of moisture to settle on their surface. Thus less of the one is left to combine with the air, or float electrically in the atmosphere, and less of the other to descend upon the soil; and the absorption by plants proceeding with increasing degrees as the condensation increases, the whole process must proceed in a gradual and gentle manner till the vapours are exhausted; and those great and sudden changes in the weather attendant on a barren, uncultivated waste, in a great degree obviated. To what general causes is the nearer approaches of the temperature of our winters and

summers toward a common medium than in less cultivated countries, or where the cultivation has been only partially extended, but to the exhalation of plants while in their vigour, and abounding in active foliage; and the conversion of the exhalations into the fluid and solid states during the comparative quiescence of vegetation, when their caloric is discharged into the atmosphere? For though there are copious showers of rain in some of the hottest months, particularly in July, large portions of the caloric of vapour being at that active season absorbed by the leaves, a far less portion of it is suffered to pervade the atmosphere than at the opposite season, when in consequence of the general absence, or almost torpid state of vegetation, it is let loose by the converging vapours in much larger quantities.

The powerful electrical attraction of the leaves for the fluid, which holds water in the state of vapour, is so clearly shown by the following experiment of Mr. Williams, that I am here induced to transcribe his account of it. "To the cup of a gold-leaf electroscope, I affixed a horizontal support of a candle; on the floor immediately under it was an earthen vessel containing hot water; the candle being lighted, hot embers were dropped into the water, which raising a cloud of vapour that passed through the candle, the electricity was collected by it, and transmitted to the electroscope, when the gold-leaf opened suddenly and struck the sides positively." Thus the presence of electric matter in vapour was demonstrated. "Some branches of trees with their foliage were now placed between the vessel on the floor and the candle; the experiment being repeated, the vapour passed through the interstices of the boughs, but the electroscope opened only *half an inch*; more boughs were now added, and the experiment was again repeated; a great part of the vapour still made its way through the interstices of the leaves and branches, but deprived of so large a portion of its electricity, that the gold-leaf *did not diverge in the smallest degree.*" This sufficiently manifests the power of vegetation in withdrawing electric matter from vapours, and, thus causing them to lose their vaporific property; but, as in this case, its action was *counteracted* by the heat produced by the fire and candle, instead of assisted by a low temperature, as in nature, "a great part of the vapour escaped, and there appears every reason to conclude, that a corresponding portion of electric matter must have escaped with it. That when thus aided by the agency of cold, the effect is much greater, appears from the following observations of the same rural electrician. On the 15th and 16th September, 1805, respectively, there was a very dense fog. On the morning of the 15th it was attended with a perfect calm, the trees and hedges being loaded with dew, but no precipitation of the fog, and the electricity strongly positive; at 8 A.M. it began to clear away; at 10 A.M. the sun shone bright and the day was tolerably fair. On the following morning the fog was equally dense; but about 7 A.M. a gentle wind arose from the south, which, bringing new particles of vapour within the conducting influence of trees and hedges, occasioned a copious fall of vapours from the leave and small branches, but no general precipitation occurred." The conversion of the vapours to the liquid state was evidently much greater than in the case of the evaporation by heat artificially applied; the positive electricity, or electric matter released by the condensation, strong in proportion; but as it was at a temperature too high to admit of a general precipitation of vapour, the whole effect was still less than it would have been at a lower temperature. The influence "a gentle breeze," in aiding the operation by bringing successive portions of vapour within the conducting virtue of trees and hedges, finely illustrates its utility in promoting the general effect.

If our former observations be founded in fact; if the life and vigour of plants depends much on the presence of a considerable supply of carbonic acid to the roots; and their production of oxygen gas to the atmosphere, on a direct administration of the acid to the leaves through the medium either of air or water, it appears highly probable that this gas is conveyed to them by the process which we are considering. It has been remarked, that carbonic acid is absorbed by the leaves from water in the absence of light; a preparation being thus going forward for its future action upon them. Here, then, an interesting question arises, how far the ma-

pours are instrumental in imparting this important element of nutrition and growth to plants? Its existence in the atmospere, in greatest abundance toward the end of the spring season and the beginning of the summer, according to the experiments of Mr. Weekes, is an interesting fact, as large portions of it must previously have been imbibed by the progressing vegetation. But its presence at this season, in such considerable quantities, seems a necessary preparation to the action of the solar beams in maintaining the verdure of the expanded leaf by extracting its oxygen. It appears probable, that during the winter months stores of carbonic acid must be imparted from the lungs of animals to the waters, either in their aerial or their liquid state, while vegetation remains comparatively dormant.

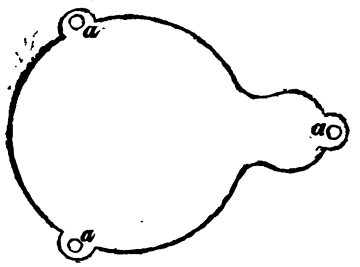
Yours, &c.

T. PINE.

Dec. 16, 1836.

ON CASTING AND GRINDING SPECULA.

(Continued from p. 266.)



Sir,—I now proceed to describe the annealing process alluded to at the close of my last letter. This would be most conveniently done by means of a separate furnace, of the same construction as that used for melting the metal, but of rather larger dimensions. This is to be gradually raised to a pretty strong heat, and a piece of cast-iron of the form of the annexed figure, and about one inch thick, with holes at *a*, for the purpose of suspension by means of chains or iron rods, is to be heaped with dry sand, and lowered into the furnace until it has attained a pretty florid red. The metal and block, on being taken out of the sand, and detached from the channel, is to be speedily and carefully removed to the iron plate, disposing the sand so that it shall afford an easy bed for the metal, and secure it from warping. The whole is to be now thickly covered with red-hot sand and re-lowered into the furnace, taking care to support the plate by means of a tile placed near the bottom of the furnace, as it would not probably bear suspension by the chains at the great heat to which it is to be raised. The expended coke from the other furnace may be thrown in afterwards, as well as a little fresh if necessary, to raise the metal to a bright red. At this point the draft of the furnace must be completely annihilated by closing and even luting up the ash-pit, which will prevent all danger of the metal re-melting. It will be convenient if the chimney and the top of the furnace can also be so closed as effectually to exclude the air. In this state the metal must be left until it becomes entirely cold, which, if the process has been well-conducted, will not be in less than from eighteen to twenty-four hours. The great object I have laboured to attain in annealing has been to raise the metal as nearly to the melting point as possible without actually attaining it, and to cool it very gradually. One metal, indeed, which was unintentionally raised so high as to begin to melt at one of its edges, turned out to be remarkably fine and brilliant.

After the metal is removed from the furnace, the first thing to be done is to break off the git by which the block is attached, which must be attempted with great care with a sharp Lancashire file. Endeavour to break it *close* to the edge of the mirror, by filing gently all round that part of the git in contact with it, and be careful to touch the face side first, as the first scratch will generally determine the place where it breaks. Both the metal and block should be supported, that the git may not be broken by the weight of either before the line of fracture is well marked out by the file; when this is done, turn the metal face upwards, and leave the block unsupported; continue the careful use of the file for a very short time, and the block will usually drop off without any blow being required.

I have thus described as briefly as I can, to be explicit, the most approved method I have employed in casting specula. I have reason to believe that it differs in some respects from that pursued by some of the most eminent London

artists; yet, independently of my own conviction, I have had the testimony of some competent judges, amongst others the late Messrs. Charles and William Tulley, to the remarkable excellence of the metals I have made.

Perhaps the most valuable property in a metal, next to that of being capable of fine polish in the first instance, is that of retaining that polish for a long period unimpaired, even under atmospherical circumstances not the most favourable. This severe test will be well borne by metals cast according to the directions above laid down, as I have been used to leave my metals constantly in their tubes undefended by any thing more than caps fitted to the ends of the tubes; and, moreover, have left them throughout the dampest seasons in outbuildings for years without their contracting any tarnish whatever, or indeed any dulness of reflection which could be detected in vision with the telescopes. Nor have I ever had to re-polish a mirror solely on account of tarnish contracted. It is much to be regretted that the composition of the metals of the late Sir William Herschel, exquisite in figure as they must have been, was very prone to tarnish, so much so as to render them sometimes, even at an early period, unfit for use. Even Sir John Herschel, now at the Cape, in a climate of which he almost speaks in raptures, states that he is obliged to have a change of metals for his 20-feet reflector, and frequently to re-polish as their surfaces grow dull.

In conclusion, it may be permitted me to mention what escaped me in its proper place—that frequent re-melting of speculum metal is decidedly injurious to it; and, therefore, all possible care should be taken to render the first casting successful. It may, however, be re-melted once or twice, adding an equal quantity of new, without apparent injury; but it generally requires a small extra proportion of tin to make the fracture flaky and brilliant.

Your most obedient servant,

WM. LASSELL, Jun.

18, Norton-street, Liverpool,
Dec. 24, 1836.

A BOLD STROKE FOR A RAILWAY.

Nothing daunted by their Parliamentary defeat of last year, the projectors of the rival lines of railway to Brighton are already in the field, and determined on another campaign. It is a pity they cannot agree to unite their forces, and thus save the expenditure of useless thousands, especially as they are now threatened with a new and formidable rival, in the person of Mr. Alexander Gordon, whilome editor of the *Journal of Elemental Locomotion*, and engineer in prospect to the "London and Holyhead Steam-coach and Road Company." This gentleman has given notice in the *Gazette* of the intention to apply for an Act for the "improvement," in whole or in part, of the road from Brighton to London, by applying a new surface, for converting the same into a hard and solid road,—just the same thing, in fact, as was to have been done on the Holyhead Line, to make it fit for the running of steam-carriages; but this is not all,—Mr. Gordon slily drags in such provisions as will enable him, if expedient, to convert the road into a regular railway. Thus he continues, "and for making a tramway or ways, stoneway or ways, *plateroad or roads of iron*, stone, or other materials, for the passing of *locomotive steam-carriages*, &c. thereon;" all due powers are to be given to collect tolls and "to apportion the same between the present trustees and the persons authorised to improve the road," *i. e.* Mr. Gordon and his company!

Messrs. Stephenson, Cundy, Rennie, and Co. had better look to it forthwith, lest some fine morning in the coming session they find not only that their own bills are thrown out, but that Mr. Gordon, while apparently asking only for powers to improve a turnpike-road, has in reality obtained the Parliamentary sanction for a new line of railway. The road Mr. G. proposes to take under his special protection is that through Croydon, Ryegate, Crawley, and Cuckfield: he starts from the Elephant and Castle.

MACKINTOSH'S ELECTRICAL THEORY—REPLY TO NAUTILUS.

Sir,—Upon reading the observations of your correspondent *Nautilus*, contained in 697 of the *Mechanics' Magazine*, it at first appeared to me that no answer was required to his animadversions. However, upon

second thoughts, I am of opinion that it may be perhaps as well to say a few words with a view to the removal of any misunderstanding which may exist in his mind, or in the minds of others of your readers. *Nautilus*, in the article alluded to, is fighting a shadow. He might very well have spared his examples of the merry-go-round, the bottle of crusted port, and the small globe, in his endeavours to prove what no one denies, that all the particles of a revolving body do each of them revolve upon its own *imaginary* axis. I was not ignorant of this when I made the assertion that the moon does not revolve upon her axis, nor do I see any necessity to withdraw or qualify that assertion from what has been advanced by *Nautilus*. *Kinclaven* also objected to this assertion, but the parallel case of the wheels and leaden balls at once enabled him to perceive that it had not been made unadvisedly. I have no intention of entering into any controversy with Nautilus upon the point—I readily grant the correctness of his views with respect to the *imaginary axis*.

His remarks upon the small machine bearing my name, and which, at the time it was first constructed, between thirteen and fourteen years ago, was expected to turn out a *perpetuum mobile*, require an answer even less than the former. It has been laying by me for upwards of thirteen years, and had I entertained all the father's fondness for the bantling, it would not have been suffered to lay so long neglected. I am fully satisfied that no perpetual motion will ever be effected, either with that machine or any other system of *mechanical combinations* that may be put together; when I sent it for publication in the *Mechanics' Magazine*, I withheld an explanation of the cause of its failing to give a perpetual motion, under the impression that the ingenuity of some of its readers might be exercised in an attempt to discover it. The attempt of Nautilus is the first, and is a complete failure. I know well that the wheel will not, and I also know the reason why it will not go, but Nautilus has not yet made that discovery.

In all that relates to declinations, right ascensions, latitude, and longitude, *Nautilus* appears to be in his proper element; but I am of opinion that he has made but few voyages of discovery in the ocean of abstract philosophy.

Yours, &c.

T. S. MACKINTOSH.

LONDON CAOUTCHOUC COMPANY—MR. SIEVIER'S PATENTS.

The rapid increase in the use of India-rubber, or caoutchouc, as a material for the manufacture of various articles, has led to a speculation, having for its object the introduction of Mr. Sievier's patents to the public, under the title of the "London Caoutchouc Company." It has apparently met with a favourable reception, as the shares have been quoted in the market at a premium. To enable shareholders and others interested in the affair to form a just opinion of the utility of the inventions, the patent right of which, it appears, the Company are to purchase at a considerable expense, we now publish abstracts of the specifications of Mr. Sievier's three patents.

The first patent, dated 1st December, 1831, is for "certain improvements in the making or manufacturing of cables, ropes, whale-fishing, and other lines; lathe and rigging bands; bags and purses; parts of which said improved articles are applicable to other useful purposes."

This invention consists in the employment of filaments or threads, India-rubber, to manufacturing elastic cables, ropes, whale-fishing, and other lines, lathe and rigger bands, bags and purses; the threads of India-rubber being previously platted over or covered with hemp, flax, silk, wool, cotton, catgut, Indian grass, strips of leather, or other fit materials.

The filaments or threads of caoutchouc are prepared by cutting them into long strips, which are afterwards stretched to their utmost tension, and wound upon drums, reels, or bobbins, ready to be platted over or covered by or interwoven with, the various materials before-mentioned.

This may be done by the machinery generally used for making sash lines, braiding, platting, or stay-lace machines, or any other machinery of the like description. The threads being thus prepared by platting over, or intermixing them with any of the above-mentioned materials, and collapsing in their length

to the degree of elasticity required, without injuring their tenacity, are for the manufacture of the various articles before-mentioned. For cables, ropes, or other articles where great strength and elasticity is required, the threads may be passed through different machines, each machine taking a strand or cord of filaments, and platting or interweaving any number of filaments together, until there are sufficient for the required strength of the article intended to be made.

For sash-lines, whale-fishing, or other lines, lathe, or rigger-bands, any required number of filaments are placed together longitudinally and covered with silk, &c., by a platting, knitting, or other machine. Lines made in this manner may be used as filaments to form cable-ropes, &c., either by placing them together longitudinally, and covering them with some material, knitted or platted, upon them; or they may be platted or interwoven together, as is before described of single threads, thus rendering an external casing unnecessary. When several large filaments are placed together to form cables, &c. by being woven round with hemp, &c. the interstices between them must be filled up with other suitable sized filaments.

Bags and purses are made by knitting threads or filaments, prepared as before described, in the same way as purses, &c. are made of silk or other common thread, by machinery or by hand. Where elasticity is required, the bag or purse may be made wholly of the caoutchouc filament; as it may be only partially used, as in carpet travelling-bags, the ends or edges only of which should be made of the elastic material, covered, when stretched to its utmost, with leather, or other suitable substance; thus when empty, the leather, or other covering, will be drawn up into puckers or gathers; stretching when any extra articles are put into the bag.

The second patent, dated January 17, 1833, is for "an improvement or improvements in the making or manufacturing of elastic goods or fabrics applicable to various useful purposes."

Mr. Sievier describes this patent as having three objects; first, to manufacture an article by the ordinary knitting-frame or similar kind of machinery, in which cords or strands of India-rubber shall be introduced between the loop or stitches of the fabric, for forming elastic bands round the margins of stockings, socks, gloves, nightcaps, drawers, and various other articles of clothing, which he effects thus:—when the stocking, &c. has been made in the ordinary way up to the part at which the elastic band is to be placed by the adjusting screws of the machine, the lengths of the loops or stitches of the row next to be produced across the machine are elongated, or contracted, in order to form a channel to receive an elastic cord similar to that described in the first patent, or else a fine strip of India-rubber itself, which is conducted by a long needle, or other suitable apparatus, answering the purpose of a shuttle, across the machine between the row of stitches or loops which were last made, and those which are then about to be formed; the India-rubber or elastic thread being drawn straight, the row of loops or stitches is completed, thus inclosing the India-rubber or elastic thread securely in its place, interwoven with the threads of the fabric, and so on. The second object is to manufacture in the ordinary loom, an elastic woollen cloth, by the introduction of cords or strands of India-rubber into both the warp and weft; which cloth may be afterwards felted and dressed with a nap. Either the warp or weft may be composed wholly or in part of the elastic cord; or the warp or the weft only may be made to contain the India-rubber; according as it may be desired, to produce a cloth, which shall be elastic lengthwise, or sidewise. Where India-rubber is introduced both into the warp and weft, it will of course be elastic in both directions. If cloth is to be produced with a nap upon its surface, yarns spun from short wool should be used with the India-rubber, which, after having been woven, should be finished in the usual manner. The third object is to produce a cloth from cotton, flax, or other suitable material not capable of felting, interwoven with elastic cords or strands of India-rubber, coated or wound round with a filamentous material.

In each case the strands of India-rubber are, in the first instance, stretched to their utmost tension, and rendered non-elastic, and being in that state into-

duced in the fabric, they acquire their elasticity by the application of heat afterwards.

The third patent is dated February 7, 1836, and is for "An improvement in the means of dissolving and preparing caoutchouc or India-rubber for various purposes." This patent is solely for the application of Ammonia to the dissolving of India-rubber. The following is the process which the patentee describes:—

"I take caoutchouc or India-rubber cut into small pieces, and put them into any convenient vessel that may be closed at the mouth; I then fill the vessel with liquor ammonia, so as to entirely cover the India-rubber; in a few months it will be dissolved, or its particles separated; I then put the solution so made into a still or large retort, and by the application of heat, nearly the whole of the ammonia will be distilled over in a gaseous form, and is to be taken up in the usual way by cold water; in that state it again becomes liquor ammonia; in this operation of distillation I prefer using a water-bath, as the India-rubber by that means cannot be subjected to a heat of more than 212° of Fahrenheit; the ammonia assumes a gaseous form at 130°. On separating the ammonia by distillation as above, the India-rubber is left held up in the water, and in that state may be applied for water-proofing cloths, or making solid masses of any form; by subjecting the solution to evaporation, any degree of consistency may be given to this solution by increasing or diminishing the quantity of water mixed with the previous dissolved India-rubber. * * * I claim as my discovery or invention the use or application of ammonia to effect the solution or separation in the manner herein described."

MAKING SERAPHINE TONGUES—AND HINTS ON MUSICAL MECHANISM.

Sir,—A "Mechanic" inquires in the Number of the *Mechanics' Magazine* for September, "What is the best metal for making the tongues of the seraphine?" I have, in the course of several years, at different times, tried experiments with the view of solving the same question; and I have lately been induced to employ steel, which, upon examination, I found was used by several manufacturers of the instrument, and also by the makers of the Æolophone. The steel which I have used, and which fully answers my expectations, is the best treble shear steel, which I get very carefully and nicely forged, and hardened by cold hammering. I then make my tongues of the steel without tempering by heat, which would give much trouble in tuning—steel produces more of a trumpet-tone than brass—which tone may be subdued by having a small wooden box (with a sliding cover for voicing, &c. over each tongue, as in the Æolophone), if the tongues are placed on a wind-chest, or by mortices through the top board if they are *within* the wind-chest, as is the case with the seraphine; and it may be still further moderated by the addition of one or two "swell-boxes" over the whole, which boxes may be well cushioned. Even with steel I fear your correspondent will occasionally have to complain of breakages. But if he fastens the tongues by screwing down upon them a small brass-plate bridge with two screws (as now adopted in the best instruments), he will find little trouble in fitting in new tongues; whereas, if he follow the old plan of fixing with a screw passing through the tongues themselves, much difficulty will be experienced in replacing and adjusting them. To preserve the tongues from rust, perhaps it would be as well, when finished, slightly to lacquer them, or, at all events, to pass over them an oiled rag. When I contrived my instrument (now between eight and nine years since), I derived my scale from one of the Æolians which a friend had just brought from Germany, and I employed brass for the tongues. They being short, and consequently thin, I was constantly annoyed by their breaking; but this defect the steel, I trust, has in a great measure remedied. Your correspondent, of course, is aware that in this particular much depends upon the weight of wind employed. The substitution of these reeds for organ-pipes appears to have been made by many individuals about the same time; and, indeed, the feasibility and desirableness of the thing would strike all who saw and heard the German Æolians when they were first introduced into this country. But I very much suspect that the invention is only the revival of an old one. In this I may be mistaken. My reasons for this suspicion are the following.—If your readers will refer to *Brewster's Encyclopedia*, art. Organ, they will at p. 674, meet with an extract from Biot's *Traité de Physique*,

from which it appears that the same kind of reed, &c. was used by Mr. Grenié in organs—with this difference, indeed, that they were enclosed in sockets, and had hollow hemispheres above them to give fullness to the tone; a construction of reed stop, which, from the *many* advantages attending it, one would have thought would have become general.

It is somewhat singular that the very same form of reed was tried by myself and my esteemed friend, Dr. Camidge, in 1819 or 1820, with the view of introducing it into the York Minster organ, which was then being enlarged. At the time when we employed this kind of reed we had no knowledge of what others had done; and the hint was derived from that very *unmusical* instrument, the Jew's harp. However, the plan was abandoned on this account; notwithstanding that the organ-builder had taken every pains in forming the reed, tongue, and pipe; and although the *tone* produced was of excellent quality, yet, either from a fault in the tongue or false proportion in the pipe, the *flat seventh* was produced so strongly with the proper note, that it was unbearable. No further experiments were tried by us, and the contrivance fell to the ground. Perhaps some of your correspondents can inform me whether the Regal, which Dr. Burney, in his "Tour in Germany," describes as a portable organ, used in processions, and formed entirely of reeds, was not something like our modern seraphine; for although he mentions the "Regal stop" in the organ at Haerlem as being an 8-foot reed pipe, yet I think this would be too long to be used in an organ for processions if it was of *full* compass. Mace, also, in his "Musick's Monument," names a "table-organ" of his contrivance. Might not this have been something of the same kind? May I be allowed to suggest that some of your scientific correspondents would confer a benefit upon musical mechanics if they would furnish a mathematically correct scale of the length, thickness at *both* extremities, and width of the tongues of the seraphine? At present, I believe no such scale is followed; for each maker adopts a different one. There are many considerations to be taken into the account in forming such a scale. If the tongues (especially of the lower notes) are too broad, they will, when in vibration, act as a tremblant upon the instrument; if they are too short, they must be filed very thin in order that they may articulate, consequently they will be liable to break; if they are too long, the vibration will be continued after the finger is removed from the key, and an unpleasant buzzing will be occasioned, unless dampers are used to check it; the strength of the tongues ought also to be proportioned to the weight of wind, or they will be continually destroyed. If a rule can be *theoretically* formed for the manufacture of these tongues, I imagine they will be regarded as pendulums (inverted), being fixed at one end, and having the weight at the other, and having a certain number of vibrations to make in a given time for the production of a certain musical note. The requisite elasticity, length, and strength of spring, with the necessary weight of wind, I leave for mathematicians to determine. Perhaps the rule used by organ-builders in making the tongues of trumpet, &c. stops, would afford some guide, if any of your correspondents would furnish it. In conclusion, I have to say that if the scale I have adopted should be of any service, it will afford me pleasure to forward it for insertion in your valuable publication.

Respectfully yours,
N. S. HEINEKEN.

Sidmouth, Dec. 29, 1836.

POPULAR SOLUTION OF O. C. F.'S QUESTION.

Sir,—In your "Old Correspondent's" scientific solution of O. C. F.'s question, he has fully proved the impossibility of gaining 20 per cent. by the transaction; but it does not appear that he has assigned any manifest reason for it, as called for in the proposition. Perhaps the following simple explanation may make the subject better and more generally understood.

The difference between $\frac{1}{3}d.$ and $\frac{1}{4}d.$, the buying and selling price of a single egg of the second parcel, is $\frac{1}{12}d.$, which is exactly 20 per cent. profit upon the $\frac{1}{4}d.$; if, then, we take the whole $\frac{1}{12}d.$ in the form of per centage (20 per cent.) there remains no surplus profit, with any multiple of which to make up for the actual loss (12*d.*) occasioned by selling the

fast parcel at a lower rate, and much less with the proposed per centage profit on the cost price (60*d.*) added to it; this, therefore, is the true cause of the limit required to be accounted for. But if from the $\frac{1}{15}d.$ we take any per centage short of 20 per cent., there will remain a certain surplus profit, which we may consider as so much per egg towards making up the above-mentioned deficiency; and this being calculated by taking the proposed per centage upon the 60*d.* and adding it to the 12*d.*, actual loss, nothing remains to be done but to divide this amount by the surplus profit per egg, and we obtain the answer required; for as this surplus profit is to the whole deficiency, so is one egg to the number of eggs necessary to supply it. For example, if 10, 15, 19, or r per cent. be proposed, we have remaining from the $\frac{1}{15}d.$ or 20 per cent., severally 10, 5, 1, and $20-r$ per cent. surplus, or $\frac{1}{30}d.$ $\frac{1}{60}d.$ $\frac{1}{300}d.$ and $\frac{20-r}{300}d.$ On the other hand, we have $\frac{60d\times 10}{100}$, $\frac{60d\times 15}{100}$, $\frac{60d\times 19}{100}$, and $\frac{60d\times r}{100}$ per centage profit, or 6*d.*, 9*d.*, $11\frac{1}{4}d.$, and $\frac{3r}{5}d.$, to each of which add 12*d.*, the actual loss, and we get 18*d.*, 21*d.*, $23\frac{1}{4}d.$, and $\left(\frac{3r}{5}+12\right)d.$, the whole deficiency; and these severally divided by the former $\frac{1}{30}d.$, &c., we obtain the results in eggs at 3 a penny, 540, 1260, 7020, and $\frac{3600+180r}{20-r}$.

O. C. W.

Dec. 13, 1836.

BELL-RINGING — PLAN TO ENABLE LADIES TO SKATE.

Sir,—For these several years past I have frequently thought of soliciting your attention to a fact connected with bell-ringing, that to me appears a complete infatuation. The mode of ringing a chime of bells in the belfries is to make each bell swing on a wheel and pivot, so as to acquire an inversed position in which the clapper strikes against it. This operation requires the utmost exertions of a set of strong men, so that it is looked upon as a feat of great prowess for eight men to ring a certain number of peals—"triple bob majors," or other "bobs," even *minors*, I suppose. The effects upon the belfries, through the violent swinging and motion of so many huge bells of many hundred weight each, is so destructive, that I could point out a dozen churches, besides that of Bow, in Cheapside, which have been threatened with ruin from the ringing of the bells. What is all this fuss and turmoil, and pulling and hauling, and puffing and sweating, endured for? To take the bell to the clapper, instead of the clapper to the bell! A bell of some tons' weight is swung round through an entire circle to produce one stroke of a clapper weighing one pound! I have heard of unexperienced ringers being caught up by the bell-rope to a great height, and then dropped on to the pavement with broken skulls and limbs. But that's nothing! They like it—and put their *foot* into a noose of the rope, by which, I hear, they are often hoisted to the ceiling. This is their affair; but is it not the business of those who pay for churches and for bell-ringing to think whether it would not be more rational, easy, and beneficial to the steeple to invite the clappers to the bells, which might then keep their huge and ponderous bodies quiet! A line attached either to the internal clapper, or to an external hammer, might be pulled by a line with the power of a child of five years old. Any village blacksmith would have enough ingenuity to apply a spring which would remove the hammer or clapper from the bell the instant after the stroke; and if desired, dampers might be added, to stop the sound, as in a pianoforte. It would be much easier to keep time by this method, as the stroke would be simultaneous with the pull of the cord; whereas, at present the bell has to make a circular swing before the hammer touches it. In fine, a peal of bells might almost be rung by an arrangement of keys in the church, like those of an organ, and played upon by one man, if not with his fingers, at any rate with his feet.

Some time ago, a clergyman, who has the direction of a public school, complained to me of having to pay a man several pounds a year for tolling his chapel-bell on a Sunday; and asked me if I could not so manage it as to have it done by one of his little girls. Of course

Paul so—and that by pulling the clapper to the bell, instead of swinging the bell round to the clapper.

The frost puts me in mind of skating, and of a plan I adopted, so long ago as 1817, to teach ladies to skate without the possibility of falling. I constructed a wicker go-cart, something in the shape of a bell. The upper rim padded, and drawn up under the arms by shoulder-straps. When put on, the bottom is only three or four inches above the ice, so that the wearer cannot fall even if she desired it. Many ladies would be glad to learn skating, but for the fear of falls. Here is their remedy, if you choose to give it them.

Your obedient servant,

F. MACRONI.

Jan. 1, 1837.

GAS-STOVES.

Sir,—As I believe gas is now brought more generally into use for the purpose of warmth, I wish, through the medium of your Magazine, to obtain some information as to the best means of applying it, and the most economical method of burning it so as to obtain the greatest quantity of heat.

There are two ways at present in use, by one of which the top of the stove is open to the apartment, and, consequently, the whole of the heated and burnt air come immediately into the room; and perhaps in open shops, and in places where the gas is well made, there is not much objection to this; but for offices and private dwellings the other plan is far preferable, for thereby the burnt air is carried away by a pipe, and only heated air is produced for respiration. However, by the latter method, a portion of the heat is lost, being carried through the pipe out of the room.

My object in writing is to inquire what is the best stove now in use for warming a room upon the *hot-air*, or *close* principle, and at the least expense, and I shall be glad if any of your correspondents who may have such stoves will favour us with the particulars of their construction, and *the number of feet* of gas *per hour* consumed, *upon an average*. I have one with a ring of 40 holes, and when burnt at a moderate height it will consume from 12 to 15 feet per hour; and I am afraid that a good heat cannot be obtained for much less; but at this rate it would be too expensive for general use, as if we reckon only 14 hours a day, it would consume more than 1000 feet per week, at a cost of above 10s. 6d.—in some places more. I have seen Mr. Rickett's stoves, and believe their consumption would exceed what I have stated. I shall be happy, however, to learn the result of the surest of all tests—actual experience.

It appears to me that the adaptation of gas for the purpose of warmth is capable of great improvement; and as it is a subject of growing importance, I hope those who can, will favour me and your readers with *working accounts* of any plan they may be adopting, and cost of construction, &c.

I am, Sir, yours, &c.

EVANDER.

Dec. 17, 1836.

P. S.—There is a curious fact connected with this subject which I should like to have explained by some of your scientific readers; whenever gas is burnt in a close apartment, the windows will become *covered with damp*. *Query*—What is the cause, and can the air be healthy to breathe? Again—If the burnt air from the gas in a hot-air stove be conveyed through an iron pipe, a quantity of steam will be continually formed, as from the spout of a tea-kettle—*query*, the cause? And is it by reason of the pipe being of iron? If so, what other material would do better for the purpose.

NOTES AND NOTICES.

☞ *Weather-wisdom put to the Proof.*—Our old friend Francis Moore has for nothing been more bitterly censured than his presuming to predict the weather. Yet, strange to relate, his trade has been taken up by the member of a scientific body,—the Meteorological Society, of which Dr. Birkbeck is president. In the course of December, they were presented with a prediction, founded on observations as to the prevailing winds, &c. of the weather to be expected in the present month, by a Mr. Murphy, as follows:—"The tendency of the weather throughout this month will be to drought. *Frost may* be expected to set in about the 5th of the month, if not sooner, and the period of greatest cold may be expected to occur on the night of the 13th, or following morning; succeeded by a thaw. Squally weather with rain thence to the 22d: after which, a return to frost, and dry harsh weather to the close of the month." Hitherto, at any rate, this prophesy has been by no means borne out by the event. The new year came in with frost, and the ground covered with snow; a thaw commenced on the night of the 2d, and by the 5th, when Mr. Murphy led us to look for frost, the thermometer looked up, and the thaw was proceeding with aug-

mented rapidity! As to the remainder of the month, "*nous verrons*," as the French say; but, what with rain and melted snow, as yet it has had but little tendency to "drought." Mr. Murphy had better have let old Francis alone in his glory!

The Keraphonite.—Amongst the presents on the table at the last meeting of the Royal Society, was an ingenious silver acoustic instrument, invented by Mr. Curtis, the King's Aurist, called the Keraphonite; it is fixed on the head for the purpose of collecting sound, which it does better than any contrivance hitherto employed. The one presented to the Society was made by Savigny, and is remarkable for its beauty of workmanship. The instrument, if such we may call it, consists of a spring, which goes across the head, terminating at either end in a small horn (hence, probably the name), which rests on the ear.—*Literary Gazette.*

Rickets's Gas-Stove.—This invention is for warming apartments where there is no chimney, and places where stoves have been used, but where the unsightly appearance and unpleasant effluvia arising from the piping are objectionable. The following is extracted from a pamphlet lately published, and which describes various new uses to which gas is applicable:—"The writer has taken particular notice of a gass-tove, fixed last autumn, by Mr. Rickets, in St. Michael's Chapel, Burleigh-street, Strand, which only cost the sum of 14*l.*, and answers remarkably well; consuming but from fifteen to twenty feet of gas per hour, whilst the attention is simply confined to lighting the gas over night, when the chapel is rendered of a comfortable temperature for morning service, a thing very uncommon, and only practicable by this mode; as every church, whether heated by steam, or hot water, or warm air, is dependent on almost an hourly attention to a fire in some part of the building. The Rev. Septimus F. Ramsey, the minister of the chapel, in answer to a letter of inquiry, states, "It affords me great pleasure to be able to say that the gas-stove, which has been erected in my chapel, has exceeded my most sanguine expectations, inasmuch as it gives a greater heat than my old warm air-stove, which cost the sum of 121*l.*"

Fire-Engines and Fire-Companies—Postscript by P. R.—I observed in my last that the question stood as originally put, viz., Why is Mr. Braithwaite's steam fire-engine not used for the purpose of extinguishing fires, or arresting their progress? Mr. Baddeley in answer to "Fire-Fury" (No. 698), says, referring to the machine, "All *do not* admit (some even deny it) of its being an effective instrument ("for both purposes"), and, THEREFORE, *it has not been adopted.* This is meeting the question. Let Mr. B. first settle that to which he has given the preference, viz. as to whether the fire-companies are or are not *irresponsible* bodies, and we shall meet him on *the second*, and I will only observe, that if the fire-companies place no reliance on the efficiency of the steam fire-engine, which Mr. Baddeley declares to be the fact, and which *Mr. Braithwaite as distinctly denies* (see his several letters), sufficient evidence may be adduced to prove that Mr. Baddeley's premises are *incorrect*, and that the conduct of his undeserving friends is no less unjustifiable in this particular case than in their conduct towards Mr. Baddeley himself. This disposition to take advantage of the labours of others, and withhold, not only remuneration, but common courtesy, will not avail the Companies in *every* instance, and I entreat Mr. Baddeley not to *overlook it* henceforth as he appears to have done, and the more particularly in his promised detailed account of the comparative merits and capabilities of steam and manual power as applied to fire-engines, which will doubtless include the new marine-engine, to be worked by three gangs of thirty men each! If this is to be worked on the *voluntary system*, Mr. Braithwaite will be blown out of the water; but the *manly-men* power item must not be overlooked. Dec. 28.—[In my letter of the 9th current, "*For*" is substituted for "*Nor*" in the third paragraph, which renders the context senseless.]

Collier's Patent Boiler.—Sir, Mr. Collier has stated in the public papers that his boilers effect a saving of *half* the fuel; and he has, in your 698th Number, not hesitated to call in question the character of the gentlemen at Woolwich who reported to the Admiralty the performance of them in the *Meteor*. Will Mr. Collier now admit or deny, in your Journal, unequivocally, the veracity of the Report to the Admiralty, which states the consumption of fuel in that vessel during her experimental trips in the River, &c. to have been *fully as much* as with the ordinary boilers. Or if he does not rely upon the performance of the *Meteor* as to the saving of fuel, will he be good enough to say where or in what vessel such fact has been ascertained. It is a great pity, Sir, that the noble cause of scientific improvement is, too often without scrutiny, allowed to be damaged, almost past repair, by the wretched fashion (to give it no worse a name) resorted to by many inventors of putting forth statements not warranted by experiment. Of course, I do not class Mr. Collier with such, unless his reply to the above shall be found to fail him.—I am, Sir, &c., T— H—.

Improvement in Fire-Tongs.—Sir, In Number 602 of your useful and entertaining Magazine, I informed you of an invention of mine for preventing lumps of coal slipping from the chaps of the tongs in carrying them from the coal-scuttle to the fire. I now find, that by boring holes through the chaps of the tongs, opposite each spike, and countersinking them on the *inside*, is an improvement on the original invention, as it permits the chaps to come closer together, and the *points* of the spikes are defended from injury, being sheathed in the holes.—I am, &c., J. BULLEN.—Bath, Jan. 2, 1837.

The Supplement to Vol. XXV., containing Title, Table of Contents, Index, and Plate of Specimens of English Medallic Engraving by Mr. Bate, was published on the 1st of December, price 6d.

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CURTIS'S TIMBER FRAME RAILWAY.

Fig. 1.

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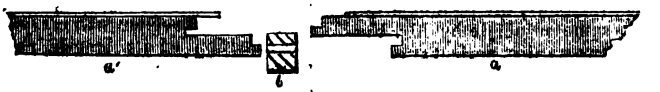

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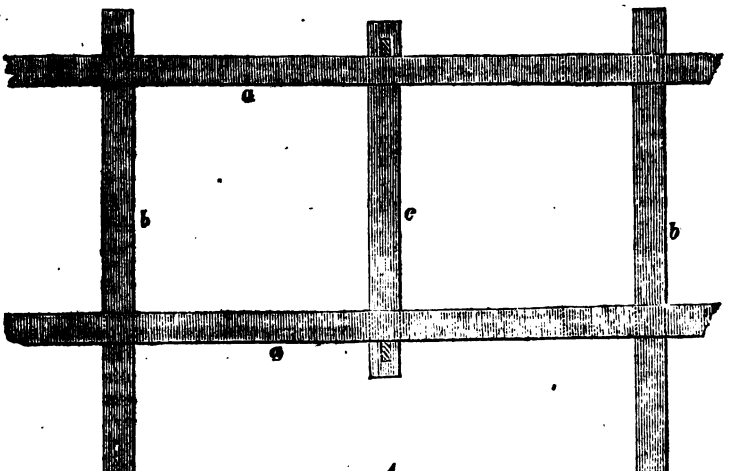

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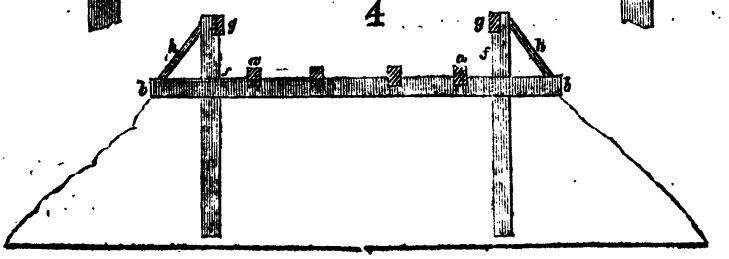


CURTIS'S TIMBER-FRAME RAILWAY.

Sir,—I beg to forward a plan of my timber-frame railroad, which I carried into effect three years ago in Mexico. A small length has been laid down in the workshops of the London and Greenwich Railroad Company, and which has been in use for about eight months without the smallest deterioration up to the present moment. I have made a public exhibition of it during all this time, and recommended it to various Railroad Companies; and to the Southampton Railroad Company I presented a model in January, last year. This model, I have no doubt, is now in the possession of the Company. I make these observations in consequence of your publishing, in your last week's Magazine, the plan of a railroad on the same principle by Mr. Vignoles. That two parties, perfect strangers to each other, should propose similar methods for effecting the same object, is perfectly intelligible; but, as amongst imaginative men, there is great tenderness felt upon the point of priority of their inventions, I send the enclosed, with its explanation, that you may lay the same before the public. Your readers will not fail to note in what respect we agree in principle, and how differ in detail. I am perfectly convinced that no method is so good as the frame-rail in all cases, and more especially in made-ground embankments. I have found in Mexico, a climate as hot as Jamaica, that although I have put the timber in green, the made-up jointing is so excellent, that the tendency which all timber has to twist only makes the joints stiffer. Putting in the timbers in 10-feet lengths requires no cross-tie, but a longer length does so. The rail, as I have drawn it, is formed of 9-inch planks placed on edge; the sleepers and cross-ties are made also from planks.

Fig. 1, is a side view, in which *a a* are the longitudinal rails, *b* the sleepers, *c* the cross-ties; and the same letters refer to the same parts in all the figures. The mode of jointing is shown in fig. 2. It is thus apparent in what way I secure the two rails and sleeper at one operation, the under tennon of *a'* entering half way into the mortice of the sleeper *b*, the rail *a* is then passed into the scarp at *a'*, and its under tennon midway into the same mortice of *b*, when the sleeper is thus held firmly between both rails, and two treenails passed through the joint makes all secure. The upper surface of the timbers is then shod with an iron bar, which is secured by wood screws countersunk. A bar of iron, a quarter of an inch thick, and 2 inches wide, weighing 6lbs. per yard, is quite sufficient. I have found that this class of rail, with only hoop-iron of one-eighth of an inch thick, suffers scarcely any perceptible deflection by our heaviest carriages passing over it; and this consequence arises from the iron being held securely between its soffits, and the effect of the load being not to crush it, but to tear it asunder—and it is a well-known fact, that a bar of a square inch section will carry a load in the direction of its length, nearly fifty times as great as when bearing (as is the case in the common rail) the load, the two ends of the rail being unconfined. The cost of a lineal yard for a double track will cost about 25*s.*, or 2,200*l.* per mile. This is a very different state of figures from that shown by Mr. Vignoles; and his arguments being indefeasible, I hope he will excuse me making them a matter of reference. Fig. 3 is a plan of the frame. In the case of a double rail the sleepers *b* must be continued across, so as to take both lines; *c* shows the tie-piece with its keys. Fig. 4 is the same thing applied upon an embankment; the sleepers *b* are prolonged, and the upright part *f f* are notched into it; along the top of these parts a rail *g* is spiked, thus making a very powerful parapet, and at a much cheaper rate than any other possible method, the whole combination having a tendency to hold up the rail. The struts *h* will furnish such security to the parts as I am certain no engine in ordinary circumstances could ever break through. N is the soil.

Your publishing the above in your earliest Number will much oblige

Sir,

Your obedient servant,

W. J. CURTIS.

Deptford High-street, Jan. 10, 1837.

THE BRITISH MUSEUM AND ITS LIBRARY.

The second volume of the Evidence given before the House of Commons Committee on the affairs of the British Museum has just appeared. It would not be easy to name a more interesting volume. Its object alone is a guarantee to the man of literature, of science, or of art, that he will find something in its pages that will come home to his business and his bosom. The way in which it is treated adds another and peculiar attraction; the information is not given as it usually is on such subjects, precisely in that manner and to that extent that it suits an individual to give it; it comes before us here in the shape of the evidence of a number of persons of the most various talents, situations, and ways of thinking, delivered before a Committee almost equally diversified, each member of which has the power of making or pursuing inquiries. The straightforward narrative is varied by the sharp question and the tart reply. The ingenious trap laid for the unsuspecting dogmatist by the opponent of his views,—the timely help afforded him by their supporter. All this lends a dramatic interest to a subject which was already in itself sufficiently attractive. To a reader across the Atlantic this ponderous folio, published by order of the House of Commons, would, we are sure, afford more lively amusement than he has often derived from a novel or a magazine; to a reader here, to one who visits, or wishes to visit, the British Museum, who takes an interest in the public institutions of his country, the interest is intense.

The volume comprises about seven hundred folio pages, of which about five hundred are occupied by the evidence on the Museum, and the remainder by the returns received from foreign countries respecting similar institutions abroad. We are sorry to be obliged to say, that this Appendix presents a feature which renders it a disgrace to those who ordered it to be printed. These returns are printed at the public expense, and presented to the Legislature of England. It is not consonant with the dignity of either the legislature or the nation, that under these circumstances any other language than the language of the nation should be employed. Till within these few years we believe no paper in a foreign language was ever laid before Parliament, to which an English translation was not added as a matter of course. On some occasion during Earl Grey's administration, in which this was omitted, it was made the subject of remark in the House of Lords, and excused on the plea of hurry. Since then, the Poor-law Commissioners have been allowed, without censure, to lay whole pages of untranslated French in a formal report before the House of Commons, and we see the fruits of their impunity in the Appendix to the present volume. In the report from Sardinia (No. 23) we find pages of French without any translation annexed; in another from the same country (No. 27) a whole pamphlet reprinted in Italian; in that from Bavaria (No. 28) *one hundred and twenty-eight closely printed consecutive pages of German*, with no translation whatever. The absurdity does not stop even here. The Appendix, No. 22, comprises an account of the public libraries of the Netherlands in Dutch, also without a translation. By some accident one has been supplied to a paper received from Mexico in Spanish; but in the preceding volume that language also was assumed to be universally intelligible, and made use of accordingly. To read this official publication of the British House of Commons, therefore, it is necessary to be familiar with no less than five foreign languages, with French, Italian, Spanish, German, and Dutch. We are certainly speaking within compass when we say that out of the six hundred and fifty-eight members of that House, six hundred and fifty are most probably incapable of reading a single Dutch paragraph. To what purpose, then, this flagrant, this indefensible, absurdity of assuming them all to be perfect masters, not only of that, but of four other languages, of which there are probably many members not acquainted with one; with not one of which, most certainly, the members of the British Legislature are, in that capacity, called upon to be acquainted. The whole proceeding, however, bears upon the very face of it such a character of insane and outrageous folly, that it is needless to waste more words in its exposure. We are glad that it has, by its extravagance, exposed itself. Such luxuriance of abuse must, at once, be put a stop to. If it be not checked now, indeed, we may expect in forthcoming reports on the improvement of education,

or the state of commerce, to be presented with untranslated volumes of Chinese and Manchoo-Tartar.

The subjects treated of in the Evidence of the present volume are very varied. The deficiencies in the library are ably pointed out by Mr. Edward Edwards; while the Rev. H. H. Baber, Librarian of the Printed Book Department, and sole selector of the books to be purchased, contends that many of the alleged deficiencies do not exist, and attributes those which he acknowledges to the scantiness of the Museum funds. The attack and defence of the scientific collections are carried on by Professor Grant, of the London University, and Mr. Gray, of the Natural History Department of the Museum, by Mr. Vigors, or Horsfield, and a host of others. The old controversy of the necessity of a classed catalogue is resumed, and Mr. Panizzi, of the Museum, maintains that an alphabetical list of subjects, such as that in "Watt's Bibliotheca Britannica," would be found more useful. A minute inquiry is made into the history of the neglect of various opportunities offered to the establishment—as of purchasing Alcuin's Bible (since obtained), Mr. Thorpe the bookseller's collection of Battle Abbey rolls, and Mr. Upcott's collection of autographs. (We are astonished that no reference was made to the rejection of Dr. Morrison's Chinese library of 10,000 volumes, an object of inestimable value.) Sir Robert Smirke gives evidence respecting the new buildings, and lays before the Committee the plans, so long expected and so long withheld, of the projected edifice. Mr. Hawkins, of the Antiquities Department, and other gentlemen, are examined respecting the expediency of a grant of public money to M. Collas, and the other French re-inventors of the American and English method of engraving medals, for the purpose of enabling them to engrave a British series. Much evidence is given respecting the comparative facilities afforded by foreign establishments, and our own to study and research.

These are some of the principal subjects treated of in the present volume of Evidence. A few of them may perhaps be examined in detail in future Numbers of the *Mechanics' Magazine*, for the present we shall confine ourselves to the comparison between the library of the Museum and its foreign compeers. On this question, a great quantity of information has been obtained by Mr. Panizzi, who, by addressing a series of twenty questions to the authorities of the chief establishments abroad, has obtained a brief summary of the leading features of each. The answers to his questions are printed all together, so as to afford at one glance a comparative view of the foreign institution; but, singularly enough, Mr. Panizzi has omitted to add a similar sketch of the main features of the British Museum itself. We shall take from his paper, which forms the most valuable article in the Appendix, the account of the Royal Library at Paris, well known for the most extensive and one of the most liberally conducted libraries in the world,—the account of that of the Museum which is placed along with it is our own. The questions are omitted, as, in most cases, their purport is sufficiently pointed out by the answers.

Paris.	*London.*
1. The name of the establishment is "The King's Library."	1. The name of the establishment is "The British Museum."
2. It contains about 650,000 volumes. It is impossible to state even by approximation the number of works.	2. The library of printed books (including "the King's,") contains about 240,000 volumes. The number of distinct works is supposed to be 300,000.
3. It is divided into four departments: 1st. Printed books; 2nd. MSS. (more than 80,000 volumes); 3rd. Medals, coins, gems, and antiques; 4th. Engravings divided into two sections, one of which is of maps, &c. with distinct keepers.	3. The library department is in two sections: 1st. Printed books; 2nd. MSS. (more than 20,000 volumes, exclusive of charters, &c.) Medals, engravings, &c. belong to the department of Antiquities in the Museum, which embraces several objects not included in the French establishment.
4. There are two librarians; two un-	4. There is a principal librarian, two

Paris.	*London.*
der-librarians; eighteen assistants of various descriptions; ten or twelve servants.	librarians of the manuscript department, and five assistants, six of the printed book department, and four assistants, sixteen attendants; (thirty-four officers in all for the library, the whole number in the Museum, including these, being seventy-nine.)
5. There are schemes of catalogues, both alphabetically arranged according to authors' names and according to subjects. Of the catalogue, seven volumes were printed off, six of which were published from 1733 to 1753. There are some manuscript supplements to it, and that catalogue is the basis on which the others are carried on. A transcript of the old alphabetical catalogue, also, is now taking place, and there are, moreover, perhaps 400,000 titles on slips not yet arranged. But the number of books absolutely uncatalogued is still enormous.	5. An alphabetical catalogue, arranged according to authors' names, was published in 7 vols. 8vo. about twenty years ago. This has been interleaved and the augmentations added, and the whole now amounts to 22 volumes folio. Besides this, there is a catalogue of the King's Library (entirely distinct from the former) in 5 vols. folio, double columns, with a supplementary volume of maps, prints, &c. The catalogues of manuscripts are those of the Harleian collection, 4 vols. folio (the last an index to the others); the Cottonian, 1 vol. folio; the Lansdowne, 1 vol. folio; the Arundel, 1 thin vol. folio; Casley's, 1 vol. 4to; Ayscough's, 2 vols. 4to; Hargrave's, 1 thin vol. 4to: these are all printed. The manuscript catalogues of manuscripts are Dr. Burney's, 1 vol. folio; those of the King's Library, 2 vols. folio; Cole's, 2 vols. folio; additional MSS., 3 vols. folio. A great number of manuscripts still remain uncatalogued, in particular the valuable Oriental collection of Rich, the Consul at Bagdad.
6. All the catalogues may be perused by readers on permission being granted, not as a matter of right. (Mr. Panizzi adds in a note—Of course the volumes which are printed are to be perused as freely as any other printed book. I never saw a reader examine one of the catalogues in manuscript. When I consulted any volume of it, one of the gentlemen belonging to the library "stood by my side.")	6. The catalogues, both printed and manuscript, are the books most frequently in the reader's hands, as, indeed, it would be impossible without consulting them to know what books were in the library. An additional copy of the printed book catalogue, in about 50 vols. folio, has been placed in the Reading-room, since the commencement of the present year (1837) for the use of the readers, and another is now preparing.
7. The library is increasing; a sum is voted annually by the Legislature for that purpose.	7. The library is increasing at the rate of between four and five thousand volumes a year, which is much more rapidly than it used to do. The funds arise from grants of the Legislature and the interest of bequests, of which the most important is that for the purchase of manuscripts by the late Earl of Bridgewater.
8. About 1250*l.* sterling a year are spent in books.	8. Some years ago the fund for buying books was so low as 200*l.* a year. The sum is now very much higher, but the precise amount is not stated.
9. Every publisher is bound to give two copies of every work he publishes to	9. Every publisher is bound to *send* a copy of every work he publishes to the

Paris.

a special officer, attached to the Ministry of the Interior. One of these copies goes to the King's Library, the other to the library attached to the *Chancellerie*. There is no complaint against this law.

10. Romances, novels, new theatrical compositions, political pamphlets, and other such light publications, are not given to readers except on cause being shown for the want of such works; nor are readers generally, and without special leave from the librarians, allowed more than one work at a time.

11. Admission is entirely free.

12. Books are to be asked for in writing, the reader being required to deliver to the librarian a ticket signed with his name and address, and containing the title of the work wanted to peruse.

13. Serious disorders have occurred in consequence of the indiscriminate admission of the public. (A vast number of the books have, it appears, from a note, been stolen or mutilated).

14. On leaving the Reading-room the reader must return the books to the librarians, from whom he receives back his ticket, which he is to leave with the door-keeper as a voucher that he has returned the book.

15. There are from 300 to 500 readers daily. It cannot be ascertained to what class the books mostly asked for belong. (Mr. Panizzi adds in a note, "I visited this library about a dozen times in January last. The lowest number of readers I have seen there has been 27, the highest 57.)

16. There is free admission for ladies as well as gentlemen. Boys under fifteen are admitted on their exhibiting a kind of certificate with their name, age, and address, signed by either of their parents, or by a head master of a public school, who answers that the bearer is trustworthy, and may be allowed to peruse the books he may want. Young

London.

British Museum, while to the Bodleian Library at Oxford, the Public at Cambridge, &c., he delivers a copy *if applied for*. There is no complaint on the part of authors as to the copy sent to the Museum, but it appears that publishers attempt to evade the obligation. It is supposed by Mr. Baber, the Librarian, that *only* five-sixths of the works published reach the Museum. It seems probable that one-half, at least, are withheld.

10. There is no restriction on the kind of works given out to the readers. Persons may be often seen engaged with the new Annuals, the "Pickwick Papers," &c. There is no limitation whatever as to the number of books allowed, and readers may be seen with as many as forty or fifty before them—few, indeed, with less than three or four.

11. Admission is granted on the recommendation of a person known to the librarians, or of undoubted respectability; it is much more easily procurable now than it was some years ago.

12. Books are asked for in writing, the reader delivering to one of the attendants (not the librarian) a ticket with his name and the titles of the books.

3. There appears to have been no serious loss sustained by the Museum for a number of years. Only two cases of theft have been mentioned in the public prints, one very recently.

14. There is no ceremony of returning vouchers. The reader leaves his books on the table if he has done with them, and if not, puts them aside in one of the book-cases to recur to them on his next visit.

15. There are about 300 readers daily. There is accommodation for about 150 at once, and the visitor who comes after twelve has often to wait for a seat. The class of books most read appears to be theology! Medical books are in great request.

16. Ladies are admitted, and are generally found in the rooms in the proportion of one to fifty gentlemen. Persons under eighteen are, in general, not admitted, but young men form perhaps the majority of the readers.

Paris.	*London.*
men, from fifteen to twenty, are admitted either upon the same terms, or on producing a ticket of admission to any special school.	
17. Books are lent under certain restrictions, and according to certain rules, which, it is hoped, will prevent the great losses and just complaints of the public which took place in former times.	17. Books are never, on any account, allowed to be taken out of the library, except to be produced as evidence in courts of law, or (it is said) in some cases for the use of the Royal Family.
18. The reading-rooms are open every day (Sundays and holidays excepted), from ten to three, for readers.	18. The reading-rooms are open every day (Sundays and a few holidays excepted) from ten till four.
19. Besides Sundays, and a few holidays, this library is not opened for a fortnight at Easter, and from the 1st of September to the 15th of October, altogether about 115 days in the year.	19. The reading-rooms are shut for a week at Easter, and a week at Christmas, on Ash Wednesday, &c.—altogether about 15 days in the year. In August, when the rest of the Museum is shut, the reading-rooms are still open.
20. No fire or lights are ever permitted in the library or reading-room. There are stoves in some of the ground-floor rooms for the use of the officers, and even in the first-floor stoves are introduced in the manuscript-rooms.	20. No fire or lights are ever permitted in the library or reading-room. They are warmed with hot air, and very effectually warmed—the late complaint of Von Raumer to the contrary being totally groundless.

Such is the result of the comparison of the two chief libraries of London and Paris, the two points of warmth, or foci of the great ellipsis of the civilised world. It will be seen that in many points the much-decried Institution of England carries off the palm of liberality from its much-bepraised rival of France; and that in others—in its refusal of indiscriminate admission to the public, or of lending books to those whom it does admit—the course which it adopts may be susceptible of defence from the evils into which the opposite line of conduct has led its competitor. But in one great point—in the chief of all—how conspicuous, how degrading is our inferiority! The Royal Library of Paris—one of several open to all comers in that capital—almost triples in the number of its books the British Museum of London, the only library of any pretensions to the character of publicity that this great metropolis can boast of. Well, indeed, may Mr. Panizzi, who, although an Italian, exhibits more zeal for the honour of England than almost any other who gave evidence before the Committee—well may he exclaim, in alluding to the disgraceful fact, that the additions made to our national collection, though now so important to what they formerly were, are neither consonant to the rank of its Trustees, the wants of the library, or the dignity of the British nation. We are glad to perceive that the Committee has advised the House of Commons to adopt the only real and efficient remedy in augmenting, and liberally augmenting, the funds of the Museum; and trust, that till the object has been gained, the example of the old senator of Rome may be fresh in the minds of the senators of England, and that as incessantly as he made use of his ungenerous and unworthy maxim, that "Carthage must be destroyed," they may repeat the generous and worthy one, that "PARIS MUST BE SURPASSED."

P. P. C. R.

BYSSUS OF THE ANCIENTS.

In the elaborate work on the "Monuments of Egypt and Nubia," recently published in Italian by Professor Rosellini, under the patronage of the Florentine government, there is a very elaborate dissertation by the learned professor on the question, whether the byssus cloth of the ancients was manufactured from cotton or flax. "I am not ignorant," says Signor Rosellini (in the second volume of that division of his work which treats of the 'Civil Monuments,'

page 341), "that this question has already been agitated by many learned men, some of whom have shown by valid arguments that the byssus of the ancients was nothing else than our cotton; but this truth is not yet sufficiently known, and the opposite opinion is still maintained by some. I have, therefore, thought it not irrelevant to the matter in hand, or useless to the cause of erudition, to collect in this place the principal arguments which demonstrate this truth, especially as it has fallen in my way to see and examine a great quantity of facts which place the question beyond all doubt." He then enters into an examination of the different passages in which byssus is mentioned in ancient authors, concluding with the well-known extract from Herodotus's description of an Egyptian funeral (in Book 2nd, chapter 86, erroneously quoted by Rosellini as chapter 119.) "When seventy days are passed, they wash the corpse, and roll up all the body in bandages of byssus cloth" (σινδονος βυσσινης). "Now," continues Rosellini, "of all the mummies that I have happened to see and unroll, whether in various cities of Europe, or in Egypt, in the necropolis of Thebes itself (and certainly I have not seen less than two hundred, the greater part of which I have opened and unrolled from the bandages), there was not a single one that was enveloped in any other fabric than cotton—it was always and invariably cotton. The fact may be easily verified," he adds shortly afterwards, "in any museum that possesses a single mummy." It certainly does appear, after such a statement as this, that the question might be considered as done with. Far from it. In the *Philosophical Transactions* for 1834, appears an essay "On the Mummy-cloth of Egypt, with Observations on some Manufactures of the Ancients, by James Thomson, Esq., F.R.S.," of Clitheroe. The fibres of cotton, it appears, when examined through a microscope, are found to consist of a number of minute fibres, twisted around each other; with those of flax, this is not the case. Mr. Thomson having procured a number of specimens of the byssus cloth from the wrappings of mummies, subjected them to minute microscopical examination, and the result he states in the following terms:—"The question debated amongst the learned of the nature of the byssus of the Ancients, I may, in conclusion, be permitted to observe, appears to me to be finally settled by the present communication. Herodotus states that the Egyptians wrapped their dead in cloth of byssus. It has been shown that, without exception, every specimen of mummy-cloth yet examined has proved to be linen. We owe, therefore, the satisfactory establishment of the fact that the byssus of the Ancients was FLAX to the microscope of Mr. Bauer." It is hazardous to decide when "doctors disagree;" but, in this instance, the rival authorities appear to be not Mr. Thomson and Dr. Rosellini, but a powerful microscope and a common pair of eyes, and the miscroscope is assuredly most likely to discriminate with correctness.

FIFTH REPORT OF THE BRITISH ASSOCIATION.

The Report of the Dublin meeting* of this migratory Society has just made its appearance, if "Report" that may be called (without an Hibernianism) whose pages bear but little reference to the proceedings it might be expected to record. In the former volumes the *viva voce* discussions of the various sections—the distinguishing feature that was to be, of the whole system—were treated with but scurvy consideration; but, in the present instance, they are treated with scarcely any consideration at all. Not contented with reiterated cautions to the reader not to suppose that the Association clothes with any particle of its authority the proceedings of the sections, the Council this year have thrust the said proceedings into an ignominious corner of the volume, with a few words of preface in a very depreciating tone, and with a half apology for giving any notice of them at all. It even seems to have been originally intended to omit them altogether, and refer the reader to the *Philosophical Magazine* for "futher particulars;" but this rigorous sentence has been softened, and they have been allowed a place (a very inferior one, it is true) for another year, in the official annals of the Association. It is, however, probably the last time of their being admitted to such an honour;

* Report of the Fifth Meeting of the British Association for the Advancement of Science, held at Dublin in 1835. London, 1836. John Murray. 8vo. pp. 488.

so that the next "Report" may very reasonably be expected to contain not a word relating to the actual proceedings of the meeting whose transactions it will profess to register.

In noticing the third Report of the Association, we took occasion to observe that it was difficult to discern the peculiar merits of its plan and mode of action; and this proceeding of the Council only confirms the belief that it in reality possesses little or no claim to distinction beyond many other Societies previously in operation. In a nation like Great Britain, which boasts of a common metropolis, to which first-rate talent, in science as in every thing else, will naturally resort, there does not exist any want of a point of union for men of science, any more than for men of letters. If our poets and novelists could be persuaded "only once a year" to meet together for a week in some provincial capital, there to bandy compliments with each other, and with the good people of the town, we dare venture to predict that a good deal of interest would be excited, and that a sufficient number of "the curious" would be assembled to gladden the hearts of the innkeepers, and double the price of bed and board; but we also venture to foretel, that should they also publish a "Report," the most valuable part of its contents would *not* be the hasty or extempore essays of the local geniuses, but the matured productions of the "lions" of the assembly—productions matured in exactly the same manner as if the "British Association for the Advancement of Literature" had never existed. It is just the same with its scientific brethren; the valuable portions of its "Transactions" consist of the Reports on the state of various branches of science made by characters of eminence in the philosophic world without any assistance from the "mob of gentlemen who talk with ease" at the great annual conglomeration—while the sum and substance of the "talk" is thrust *nem. con.* into a hole and corner, with divers warnings that it is little better than rubbish. The question naturally intrudes itself, under these circumstances, Why, so far as the advancement of science is concerned, should not all these good folks keep themselves at home, and the Council of the Association publish the communications sent them, without the previous ceremony of a multitudinous meeting, which, after all, has so little connexion with the matter, that those communications are not even read at them?

Such questions as this so naturally arise, that the admirers of the Institution are frequently obliged to enter the lists in its defence. At the Dublin meeting, for instance, the President, the newly-made *Sir William* Hamilton, who had, we believe, been knighted that morning by the Lord Lieutenant, entered, in his inaugural speech, at considerable length into the question of the peculiar claims of the Association. It will be but fair to let him speak for himself, and then to hazard a few words of remark. Sir William first conjures up an imaginary assailant, and then proceeds:—

"Presuming, therefore, that some one now demands how this Association differs from its fellows, and what peculiar means it has of awakening and directing to scientific purposes the power of the social spirit; or why, when there were so many old and new Societies for science, it was thought necessary or expedient to call this Society also into being—I proceed to speak of some of the characteristic and essential circumstances of this British Association, which contain the answer to that reasonable demand. First, then, it differs in its magnitude and universality from all lesser and more local Societies. So evidently true is this, that you might justly blame me if I were to occupy your time by any formal proof of it. What other Societies do upon a small scale, this does upon a large; what others do for London, or Edinburgh, or Dublin, this does for the whole triple realm of England, Scotland, and Ireland. Its gigantic arms stretch even to America and India, insomuch that it is commensurate with the magnitude and the majesty of the British empire, on which the sun never sets; and that we hail with pleasure, but without surprise, the enrolment of him among our members who represents the sovereign here, and is to us the visible image of the head of that vast empire; and the joy with which we welcome to our assemblies and to our hospitality those eminent strangers who have come to us from foreign lands, rises almost above the sphere of private friendship, and partakes of the dignity of a compact with all the nations of the earth. Forgive me that I have not yet been able to speak calmly in such a presence, and on such a theme. But it is not merely in its magnitude and universality, and consequently higher power of stimulating intellect through sympathy, that this Association differs from others. It differs from them also in constitution and details; in the

migratory character of its meetings, which visit, for a week each year, place after place in succession, so as to indulge and stimulate all, without wearying or burdening any; in encouraging oral discussion, throughout its several separate sections, as the principal medium of making known among members the opinions, views, and discoveries of each other; in calling upon eminent men to prepare Reports upon the existing state of knowledge in the principal departments of science; and in publishing only abstracts or notices of all those other contributions which it has not as a body called for; in short, in attempting to induce men of science to work more together than they do elsewhere, to establish a system of more strict co-operation between the labourers in one common field, and thus to effect, more fully than other Societies can do, the combination of intellectual exertions. In other Societies the constitution and practice are such, that the labours of the several members are comparatively unconnected, and few attempts are systematically made to combine and harmonise them together; so that if we except that general and useful action of the social spirit upon the intellect of which I have already spoken, and the occasional incitement to specific research, by the previous proposal of prizes, there remains little beyond the publication of 'Transactions,' whereby they seek as bodies to co-operate in the work of science."—p. xlv.

Sir William's first assertion we certainly shall not combat. Even an *Irish* meeting might well blame him for occupying their time in the "formal proof" of a proposition so very "evidently true" as that the Association "differs, in its *magnitude* and *universality*, from all *lesser* and *more local* Societies!" In his second, he is not so fortunate; he labours under a mistake in supposing that the Societies of London, for instance, confine their researches to matters within the compass of the bells of Bow—the "triple realm" is as much embraced by the plan of the Royal and other Societies as by that of the British Association, and there is scarcely any scientific Society of any pretensions in the kingdom whose "gigantic arms" do not stretch to America and India, or even remoter portions of the globe. Does Sir William really entertain the notion that all the F. R. S.'s (he is himself included) are dwellers in the land of Cockaigne—or that "Jemseetjee Jeejeebhoy," or the Pacha of Egypt (by way of example) are regular "metropolitan members" of the Asiatic Society? Assuredly not; a moment's reflection would have shown him that this peculiar characteristic of the Association is no peculiarity at all. The only real peculiarity is that next brought forward —the "migratory character of its meetings"—and we have already seen how *high* a value is set upon this feature of the plan by no less competent judges than the Council of the Association; and, as to the "Reports on the State of Science," it is hard to discover in what especial manner the "principles of co-operation" has been exercised in their getting-up, seeing that each separate Report has been the production of one sole author, labouring in his own study, far away, both in time and place, from the social spirit-exciting meetings of which Sir William volunteers to be the chivalrous defender. Yet it is on these Reports, thus produced, that, singularly enough, the worthy President rests as the main strength of his defence. Returning to the charge, he observes:—

"We must still turn to this British Association, as the body which is *corporative* by eminence. The *discussions* in its sections are more animated, comprehensive, and instructive, and make minds which were strangers more intimately acquainted with each other, than can be supposed to be the case in any less general body; the *general meetings* bring together the cultivators of all different departments of science; and even the less formal *conversations*, which take place in its halls of assembly, during every pause of business, are themselves the working together of mind with mind, and not only excite but *are* co-operation. Express requests are also systematically made to individuals and bodies of men, to co-operate in the execution of particular tasks in science, and these requests have often been complied with. But, *more perhaps than all the rest*, the Reports which it has called forth on the existing state of the several branches of knowledge are astonishing examples of industry and zeal, exerted in the spirit and for the purpose of co-operation."—p. xlvi.

It is even specially unfortunate that so much should have been said upon this topic in a speech which is made to take the place of a preface to the present volume—since, as it happens, this "fifth Report" is remarkably deficient on that head. Both the third and fourth Reports included a considerable number of very valuable papers of this class, while this, with such a flaming panegyric in its

front, can only boast of three—and two of these are of such a nature as to reflect any thing but honour on a "British Association." Desperate we may well suppose to have been the straits to which the Council were reduced, when we find they have procured only *one* original Report, that on the "Recent Progress and Present Condition of the Mathematical Theories of Electricity, Magnetism, and Heat," by the Rev. W. Whewell—for insertion in a volume extending over a year in space. But nothing can justify the manner in which they have made up the deficiency, so far as it is made up; in the first place, by a Report "On the Phenomena of Terrestrial Magnetism, *being an abstract of the* 'MAGNETISMUS DER ERDE' *of Professor Hansteen*," by Captain Sabine; and, in the second, by a long essay *wholly in the French language, and without a word of translation*, "On the State of the Mathematical Sciences *in Belgium!*"—*Aperçu de l'Etat Actuel des Sciences Mathematiques chez les Belges, par A. Quetélet, Directeur de l'Observatoire de Bruxelles.*

Alas! for the British Association, if its most valuable feature be reduced to such a state of depression as this! What, has the wonderful co-operative tendency of its constitution so lost its power, that only one "astonishing example of industry and zeal" can be produced in a whole year, after all the "working together of mind with mind" at the conversations in its halls of assembly—or has this "working together" so little to do with the matter, that, if the *separate workers* who have hitherto supplied this important department choose to stand aloof, the Council are forthwith compelled, for lack of better matter, to fill up their pages with a second-hand abstract of the investigations of a German professor, or, worse than all, with an essay by a foreigner, on a foreign subject, and in a foreign language? Is the "co-operative spirit" so weak, that it could not even produce a translation of this specimen of the labours of a British Association (represented in this instance by a sole and solitary alien) into the tongue of Britons? If this much-vaunted spirit be in so miserable a condition, in the name of British science let the Association drop this part of the plan at once, and not exhibit their pitiable poverty to the jeers of an unfeeling world. Ten times better would it have been, in the present instance, had pages 35 to 91 been left blank rather than occupied as they are; and, for the future, it would be far preferable to omit the "feature" altogether, rather than exhibit such a disfigured and scarcely-recognisable apology for it as disgraces the present Report.

It is some consolation, under the circumstances, to find some improvement in another branch, counterbalancing in some degree the woeful falling off in this. Under the head "Researches undertaken at the request or suggestion of the Association," we are presented with a considerable mass of information on a variety of subjects, offering altogether a complete contrast to the meagreness of the preceding section. We have to regret, as usual, that but too little attention is paid throughout to practical science; the only contribution to this department of any consequence in the volume is the elaborate Report on the "Impact upon Beams," by Mr. Eaton Hodgkinson, who has performed a very extensive series of experiments on the subject at the desire and expense of the Association. The remaining principal papers in the division of "Researches" are, "On the Direction and Intensity of Magnetic Force in Ireland," (which is illustrated by several maps, which reflect the highest credit on the engravers of Dublin), by Dr. Lloyd, Captain Sabine, and Captain Clarke Ross, the discoverer of the Magnetic Pole;—"On the Radiation of Heat," by Mr. Hudson, of the Royal Irish Academy; "On Acrid Poisons," by Drs. Roupell and Hodgkin;" and two interesting collections of meteorological data—"the Quantities of Rain falling at different Elevations at York," by Mr. Gray and Professor Phillips; and "Hourly Observations on the Thermometer at Plymouth Dock-yard," which have been procured by means of a small grant from the funds of the Association for that purpose, placed at the disposal of Mr. Snow Harris. We need hardly say that the contents of the concluding portion,—that on the proceedings of the sections, which is paged separately from the rest,—are of little value. The notices are generally so short as to afford scarcely the means of even collecting what are the views and opinions advanced, and in many instances not so much as a word of explanation is given,—nothing more than the bare title of the

paper read; such is the case with a paper which promises some interest to mechanical readers. "On Certain Points in the Theory of the Construction of Railroads," by Dr. Lardner and C. Vignoles, Esq. What these points were, and in what manner they were treated, must be gathered from other sources, for not a syllable is vouchsafed on the subject in the Report.

TIMBER RAILWAYS.

Oak and Screws versus *Fir and Nails; and Concrete* versus *Loose Gravel.*

Mr. Vignoles, civil-engineer, has published, in the form of a Report to the Directors of the Midland Counties Railway Company,* a plan for making the upper works of railways; by adopting which he proposes to save, in two trackways, from 800*l.* to 2,200*l.* per mile. He might have said much more; and I fully concur in opinion with him, that "a more economical and better mode of construction might have been adopted by the Directors of the London and Birmingham, and other principal railways now in the course of construction," than that to which, despite the Report of Professor Barlow, and the other warnings they have had, they seem by some fatality resolved to adhere; in which opinion, I unhesitatingly assert, the shareholders in the London and Birmingham railway will also concur when, at no great distance, they will be informed that the Directors must have fresh powers, either to issue an additional number of shares, or to borrow additional sums on mortgage, either being to the manifest detriment of the original shareholders, over whom the money lenders, in whatever form they may present themselves, will have a decided advantage. It is now too late for the shareholders of the London and Birmingham Railway Company, and those of the other railway companies alluded to by Mr. Vignoles, to profit by his judicious, though sarcastic reflections; but other companies may take the hint, and avoid the rock on which their inexperienced, if not obstinate, predecessors have split.

Mr. Vignoles, however, understands theories somewhat better than making calculations and estimates; for he writes down the cost of a stone sleeper, of five cubic feet, (which weighs from six to seven cwt.) 4*s.*; whereas the lowest price at which granite, or other equally hard and suitable blocks, can be procured at any quarry, is about 1*s.* per foot; and, whereas the cost of transport from the quarry to any spot on the London and Birmingham line, cannot, upon the average, be less than 20*s.* per ton, which is 6*s.* 6*d.* per block. I know that 7*s.* 6*d.* each is asked for Yorkshire blocks (not granite) in the River Thames; to which price are to be added lighterage, unloading into canal boats, canal conveyance to the spot nearest to the railway; landing, loading, and cartage to the railway, and hawling along it, (perhaps some miles,) to the place where the blocks are to be laid down.

Mr. Vignoles' plan is to use *fir* planks, nine inches wide, and four and a half thick, bedded on ballasting, which is loose gravel, as a *continuous* support of his frame-work, on which are mounted rails, at the top resembling the rails at present in use, though their base is five inches, and they weigh 48lbs. per yard.

Now, as this gentleman advocates the continuous support of the rails, and represents wood, *even fir*, to be a much better bearer for rails than stone blocks, it is singular that he should not have called the attention of the Directors of the company in question to my plan, of which these two objects form so prominent a feature. Of its superiority over the existing mode of construction, we have (at least in reference to these objects) a decided confirmation, as Mr. Vignoles, in respect to theory, is held to be an authority.

Mr. Vignoles intends to hold together the two longitudinal bearers for each track-way by wooden girders, at a short distance apart, so that the whole will form a frame, something like a huge ladder: and to secure the rails to the frame-work by nails or spikes; and if wrought-iron rails are used, each track-way, (that is two rails for a carriage to run on,) will, according to his estimate, cost 22*s.* per yard, or 11*s.* for a single line of rail.

Whether loose stones will constitute a continuous, solid foundation, especially on clay and other soft earth; and whether any dependance can be placed on the stability of the frame-work, that is, its continuing an absolute fixture, consider-

* See *Mechanics' Magazine*, No. 701.

ing the nature of the trial to which it will be subjected, I must leave the public to judge, entertaining the opinion, that a decided preference will be given to bearers *buried in and consolidated with a bed of concrete;* two feet or more wide and deep, and which, for solidity, strength, and durability, will resemble a continuous rock, the whole length of the road.

Then, the species of wood to be employed for bearers. Mr. Vignoles is for fir, which after being *kyanized*, he supposes will last seven years; but I am for oak, which after undergoing the same process, will last seven times seven years; and during this period no interruption be occasioned to the traffic, by taking up old bearers and putting down new ones. Again, Mr. Vignoles will secure, (that is, if wet, dry, and hot weather permit,) the rails to *fir* bearers by *nails;* but *screws* in *oak* bearers render my plan independent of the influence of the weather.

Now, as to price: Mr. Vignoles' plan costs 11*s.* per yard; but I have made known that the maximum price of mine will be 10*s.*, though in many, perhaps in most parts of the country, the price will not exceed 8*s.* per yard, even if it does 7*s.*; and were Memel fir to be used instead of oak, and nails instead of screws, a further diminution of 1*s.* per yard might be made. But who that reflects would thus economize? Mr. Vignoles' iron rail costs 5*s.* 7*d.* per yard, but mine only 1*s.*; and where he uses four feet of fir, I use only one of oak. He has no means for the bars to expand and contract, but upon my plan this advantage is enjoyed.

In conclusion, I thank Mr. Vignoles for his publication, which, on account of its theoretical data, I deem of great value.

THOMAS PARKIN.

Patent Railway Office,
31, Broad-street-buildings, Jan. 16, 1837.

MR. PINKUS'S IMPROVEMENT (?) IN HIS PNEUMATIC RAILWAY.

In our 612th Number we "nipt i' the bud" as promising a speculation upon the credulity of share-buyers as was ever advertised. It did not, however, come under our notice until the plausibility of a working model had worked upon the pockets of some, and the paid for opinions of certain opinion-giving doctors upon those of others. The miniature railway was a good hit, and told well; there are so few who understand the relation between a machine and its model.

Mr. Pinkus, convinced in spite of himself (whether by our remarks or not, we aver not), that his plan would not do; and seeing, also, that this began to be the opinion of some who had at first supported him, he bethought himself of another, and what he calls an improved plan, for which he forthwith took out Letters Patent. Upon this new plan a short experimental line has been commenced by the side of the Kensington Canal. The air-mains or tunnels, however, have been lying there some time, and are becoming rather rusty —operations having for some reason or other been suspended. We hardly know whether it be worth while to enter into the details of a plan, the foundation of which we hold to be absurd; but as Mr. Pinkus evinces considerable ingenuity in his improvement, we shall shortly describe it. He altogether dispenses with the travelling diaphragm, and diminishes the size of his air-tunnels to a fourth of what was originally proposed; in fact, the air-tunnel is the only feature common to the old and new plans.

As we before observed, the travelling diaphragm is now altogether dispensed with. The railway is to be divided into sections of five miles length; at each of which lengths there is to be a fixed steam-engine, working air-pumps. The diameter of the mile and quarter of air-main next each station is to be of 11 inches, and the middle 2½ miles, to be of 9 inches. The pumps at each end act upon the air in the tunnel, continually rarefying it, as it is thrown in by the working of the locomotive-apparatus. The main is to have an opening in the upper surface two inches wide; on to the edges of this opening are to be attached plates, forming what Mr. Pinkus calls a "metallic valve," made of an amalgam of iron and copper, hard rolled to make it elastic, $\frac{1}{4}$th of an inch thick at the lower edge, and $\frac{1}{16}$th at the upper (the insides of which are to be polished smooth), and four inches high. The annexed cuts will show the thing more clearly. Fig 1 is a plan of the valve, and fig. 2 a cross section of the air-main, with the valve attached, and the tongue (afterwards described) between the lips of the valve. In both figures *a a* are the lips of the valve,

Fig. 1.

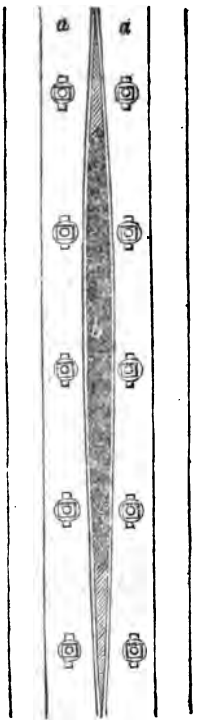
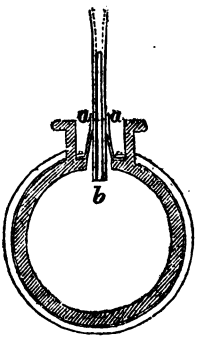


Fig. 2.



which it will be seen, in their undisturbed state, by their elasticity press upon one another and form an air-tight joint the whole length of the main. Working between the lips of this valve is a hollow metallic tongue (*b*, fig. 2,) the shape of which is seen in fig. 1; the sides of this tongue, in contact with the lips of the valve, are polished, and the tendency of the latter to collapse by their spring, pressing upon these polished sides, as they pass along makes the joint air-tight. This hollow tongue forms a communication through throttle-valves with a condenser or vacuum-vessel; and this vacuum-vessel communicates through alternating openings (somewhat similar to those used in steam-cylinders, and worked by an eccentric from the crank), with two cylinders, in which work pistons, whose rods turn cranks, which give a rotary motion to the wheels of the locomotive. The mode of action is as follows:—The air in the main is kept rarefied by the exhausting-engines at each end; a communication being made between it and the rarefied air or vacuum vessel, by opening the throttle-valve—and between the vacuum-vessel and the cylinder by the sliding passage, a partial vacuum is formed under the piston, which the outward atmosphere forces down, giving half a turn to the crank; the alternating air-passages are then reversed—the other piston is acted upon in the same way—and a revolution of the crank, and consequently carriage-wheel, is completed. The cylinder-full of air, after having forced down the piston passes into the vacuum-vessel, and through the hollow tongue into the main, from which it is pumped into the atmosphere by the stationary-engines and air-pumps at each end of the five-mile section. As the tongue passes forward between the lips of the valve it will open a passage for itself, which will immediately close behind it by the elasticity of the plates. The tongue is prevented from becoming hot by friction by the current of cold air constantly passing through it from the cylinders. This, we believe, is all of Mr. Pinkus's specification, which is wanted to give our readers an idea of his improvement—there are several minor points which it is unnecessary for us to refer to.

Our readers will perceive from the foregoing sketch that Mr. Pinkus's said *improvement* is worse than his original plan—inasmuch as he has added complication of parts and weight of machinery. We could suggest an improvement, whereby Mr. Pinkus would save air-pumps and steam-engines at each end of his five miles. Let him make his vacuum after Savery's plan,

and he will want nothing but a boiler and furnace!

It would be useless to enter further into the demerits of the scheme. From the Mansion-house police reports a few weeks ago (by which it appears that Mr. Pinkus was bound over to answer at the Sessions a charge of assault upon the Secretary, for not allowing him to inspect the Committee Minute-book,) we perceive that the Directors of the Pneumatic Railway Company are just opening their eyes to its futility, and have been passing some vote of censure upon Mr. Pinkus—why, it is not difficult to divine.

In fine, until Mr. Pinkus can give to air properties which it has not, or rather, take from it one property which it has—its elasticity—no train of carriages will ever yield to the pull of his "atmospheric rope."

THE CASE OF DEFECTIVE VISION.*

Sir,—A letter appeared in the *Mechanics' Magazine* of the 3rd of December last, from a Manchester artist, under the signature of "W.," stating, that he was unable to distinguish colours, and requesting of you or of your readers information respecting any remedy for the defect.

It is much to be regretted that persons having such a defect as your correspondent, should choose a profession which requires skill in the distinction and distribution of colours, for such a defect cannot be remedied. It is, therefore, only in my power to point out its cause. I presume, by the silence of "W." on the subject, that he experiences no difficulty in seeing objects clearly, and that his only defect is the one he has stated. If this be the case, his defect is not a visual but a cerebral one; for it has frequently been observed that persons unable to distinguish colours have possessed perfect vision. The cause of this apparent anomaly was unknown, till Gall discovered that each faculty of the mind has its seat in a certain portion of the brain, and that according to the size of such portion, so is the power of its faculty, and, that the function of a part of the brain situated at the middle of the eyebrows is the perception of colours. The truth of this discovery is every day verified by its being observed that persons who are unable to distinguish colours, have that portion of the brain depressed; a depression which a practical phrenologist would undoubtedly ascertain upon examining the eyebrows of "W.," and which would sufficiently account for the defect, without any reference to the visual organs. In conclusion, therefore, I would advise "W." to restrict himself, if possible, to a branch of his profession in which the perception of various colours is not required, for his defect is one which no culture can overcome.

I am, Sir,
Yours respectfully,
GEO. JOHNSTON.

16, Regent-square, Dec. 23, 1836.

* See *Mechanics' Magazine*, p. 164.

THE INSURANCE-COMPANIES AND THE PUBLIC.

Sir,—Be pleased to allow me the privilege of a brief reply to Mr. Baddeley's last.

Mr. Baddeley does not answer the objections as stated in my letter, further than by informing us—

1st. That Companies are composed of individuals! This startling truth, which certainly does not require the additional sanction of Mr. Baddeley's name—neither proves that *he* is right in asserting the utter irresponsibility of the Insurance-Companies—nor that I am wrong in denying it.

2dly. We have the *gratuitous assertion* that no parallel exists between one public Company and another.

Now, the whole nucleus of the question rests on these facts. Mr. Baddeley avoids *both*. Is it that he dares not to meet the consequences of his argument? or is he satisfied to leave the matter to your readers?

Whether or no the Companies are able to realise the amount of their liabilities to the community, if so called upon to do, is, thanks to the precautions of the *public*, not likely to be put to the test. It is not irrelevant, however, to remark, that many Fire-insurance Companies were ruined by the late calamity in New York.

Mr. Baddeley says triumphantly, now it is the *insurers* who complain. They

do complain, and have a right to complain, if sufficient protection be not extended to every description of property insured or *uninsured*. Cannot Mr. Baddeley imagine the one description may endanger the other, and *vice versâ*?

Mr. Baddeley takes exception to the word "*Fire-police*:"—let any more appropriate be substituted he pleases; at the same time, he should *prove* that my *argument* is fallacious, and that the *Fire* Companies are not responsible, as he tacitly admits other companies are, and as I maintain them to be, one and all.

Till these matters are settled, I apprehend we shall arrive at no very clear conception of the *relations* existing between the public and the Fire-offices; meanwhile, I recommend "Aquarius" to Mr. Baddeley's notice. I shall not further disturb him in the concoction of his annual fire-report—with which, I presume, he is now engaged—and which will, no doubt, throw more light upon the subject in question.

I am, Sir,

Yours respectfully,

P. R.

Jan. 9, 1837.

NOTES AND NOTICES.

Bell-Ringing.—Sir, Our indefatigable friend Col. Maceroni has broached the subject of bell-ringing in his last communication, and from the tenor of his remarks upon that subject, it is evident he is not aware of what has already been done towards reforming the present barbarous mode of obtaining the full sound from large bells. I beg to refer him to the 12th volume of your Magazine, page 281, where he will find a chapter on bells, in which the method of "pulling the clapper to the bell," occasionally resorted to, is noticed, and the reason why it is not generally adopted, explained. In the same paper, Mr. Drury's very superior mode of bell-ringing, or rather bell-striking, is fully described; a method so well adapted to the object required, that it is a matter of surprise it has not been universally employed.—I remain, Sir, W. BADDELEY. London, January 18, 1837.

Triumph of Railways—A Locomotive forcing its way through a Snow-Drift.—It was matter of some curiosity whether or not the engine could continue to work upon the Newcastle and Carlisle Railway during the continuance of the snow upon the road. The possibility of so working was fairly put to the test on the 26th ultimo, and the utility of railways demonstrated in a most striking manner. In the deep cutting through the Cowran Hills the snow had drifted to the depth of four or five feet; and when the "Hercules" came down on Monday morning great numbers of country people had assembled to see how he could act in such an emergency, and to render any assistance which might be necessary. On arriving at the spot the engine made no bones of the matter, but dashed right into the drift, clearing his way through, apparently without the slightest difficulty, the snow at the time flying over the top of the engine chimney like foam from the broken waves of a violent sea; and notwithstanding this and other similar obstructions, the train came down from Greenhead (twenty miles) in an hour and a quarter. The trains have continued regularly to keep their time, while all communication by common roads has been more or less most seriously obstructed, if not entirely cut off for a time.—*Carlisle Paper.*

The Gresham Lectures are now in course of delivery at the old locality,—up stairs at the Royal Exchange, near Effingham Wilson's corner. Hitherto, they have been attended by sufficient numbers to compel the lecturer to go through his task, which he declines to do when less than the canonical number, three, are present. Worse than this, reporters have the audacity to take down the lectures in short-hand, and a contemporary periodical threatens to publish the whole *seriatim*—if the patience of the public should hold out.

Steam Communication with India.—At a meeting, last week, of merchants trading to India and China, held at the Jerusalem Coffee-house, a resolution was unanimously passed in approval of the project for effecting the communication by steam *via* the Red Sea. It is a pity the meeting did not go further, and forthwith resolve to *petition Parliament*. Half-a-dozen petitions, from London and the principal outports, would do more, in conjunction with those already in the hands of Lord W. Bentinck and Mr. Crawford, from Madras and Calcutta, for presentation early in the ensuing session, —than fifty meetings where "resolutions" are passed,—" and there an end."

Errata.—Page 262. 1st column, 10th line from the top, instead of "nearly four millions," read "nearly four hundred millions."

Same page, 2nd column, 29th line from top, for "Have cut one gash," read "Have only to cut a gash."

Page 263, 1st column, 16th line from top, for "useless" read "useful."

The Supplement to Vol. XXV., containing Title, Table of Contents, Index, and Plate of Specimens of English Medallic Engraving by Mr. Bate, was published on the 1st of December, price 6d.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

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MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

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WEST'S PATENT FORGE-BACKS.

Fig. 1.

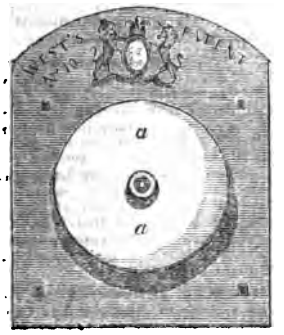


Fig. 2.

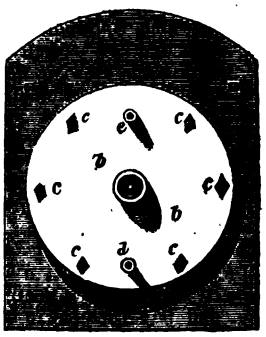


Fig. 3.

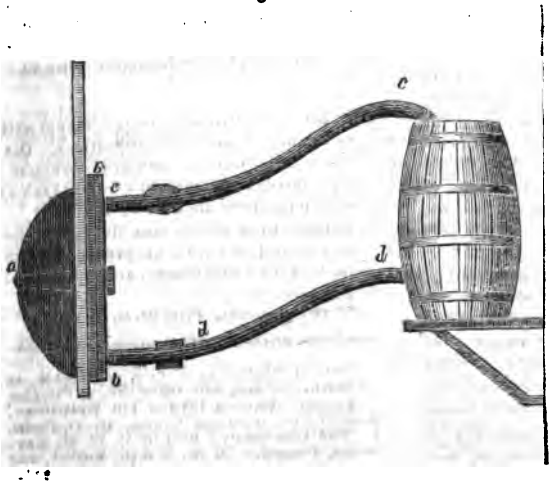
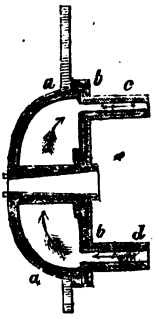


Fig. 4.



WEST'S PATENT FORGE-BACKS.

The rapidity with which forge-backs of the ordinary construction are destroyed by the intensity of the heat to which they are continually subjected, has led to the invention now described, and which was patented by Mr. West, of Crayford, a blacksmith, in December, 1834. The invention consists in the introduction of a current of water behind the forge-back, which, as is obvious, preserves the metal from destruction by the fire.

Fig. 1 represents a front view of a forge-back, which is made hollow in order to admit of a flow of water.

Fig. 2 is a back view of fig. 1, by which the position of the circulating pipes is shown.

Fig. 3 is a side view of a forge-back.

Fig. 4 is a side section, by which the action of the water will become more evident, the arrows indicating the flow of the water.

The back of the forge is made up of two parts, *a* and *b*—the part *a* being the front or part against which the fire or hot coals lie, and is consequently that part in the ordinary back which is liable to be quickly destroyed; but when constructed in such a manner as to admit of a constant flow of water against the back surface, this part *a* will be less prejudicially acted on by the hot coal, owing to the heat being constantly conveyed away by the circulation of the water. *b* is the back part of the forge-back. These parts are kept together by screws. *d* is the induction-pipe, and *e* the eduction-pipe, which respectively lead from and to a tub or vessel containing water, which is placed in any convenient situation in order that water may constantly flow to and from the hollow forge-back *a b*.

The advantages of these backs are their indestructibility—that the clinker does not adhere to the back, and consequently that the fire need never be disturbed for the removal of the clinkers—that they always burn cool; and as every smith is aware that they never work so comfortably, nor get their heats so well as they do while the back of the forge continues cool, this must be a great recommendation.

There is also a positive saving of more than 20 per cent. in coals.

The tub or vessel for the water may be placed in any part of the shop, so that it is above the level of the back, and one tub or vessel will do for any number of backs.

The back is to be connected to the reservoir or tub by leaden pipes.

ON THE PHENOMENA PRODUCED BY WATER UPON HIGHLY-HEATED METALS. BY CHARLES TOMLINSON, ESQ.

Sir,—I have read with considerable interest the "Report of Experiments on the Explosions of Steam-boilers," copied by you from the *Journal of the Franklin Institute*, and particularly that part of it referring to Klaproth's experiments relating to the conversion of water into steam by highly-heated metals; but I was disappointed on finding that results only were stated, and no attempt made to elucidate the cause, or to obviate the consequences of the remarkable phenomena referred to.

The subject has engaged a portion of my attention during the last three or four years; some time ago I wrote, but did not publish, a paper on this subject, and have more recently enlarged the inquiry. You will probably allow the matter to be of sufficient interest to insert what I now send you, although I fear it will be found tedious to your readers, since my results are not altogether new—for, indeed, long after they were obtained I met with, from time to time, papers on the same subject when I little expected to find them, containing experiments similar to my own, although affording in some cases dissimilar results.

This has hitherto discouraged me from publishing; and I should not attempt to do so now, but that the American Report has imparted a freshness to the subject—and I do hope that this paper will excite inquiry among the numerous and highly intelligent, as well as practical, gentlemen who contribute so largely to your pages.

When water falls upon a red-hot iron plane surface, it suddenly divides into drops—each drop assumes a spherical form, rotates, and remains upon the plate longer than would seem natural, considering the high temperature to which it is exposed. Now, if a platinum crucible be brought near to a white heat, and water be allowed to fall into it drop by drop, the crucible may be nearly half filled with water, and be kept in this

state for some minutes without any perceptible evaporation. A piece of cold glass or metal will receive no deposit of moisture if held for a moment within the crucible (although the temperature of the water is supposed to be nearly double that of boiling water), and the water suffers diminution almost imperceptibly. In this state the water will be observed to be in rapid motion, rotating "about an axis perpendicular, or nearly so, to the lowest point of the dish, and at the same time its figure changes, and, from being circular in its horizontal section, becomes of an irregular oval, which contracts and dilates alternately as the mass revolves; the transverse axis contracting until its place is occupied by the conjugate, and *vice versâ*. The direction of this rotation is not at all uniform, and the mass sometimes becomes quiescent, and then assumes motion in an opposite direction. When this state of things first begins, vapour sometimes bubbles or bursts up through the liquid; but when fully established, it is most copiously given off below. In fact, the appearance is that of a stratum of vapour between the water and the bowl, which becomes at times visible when condensed at the edges."—American Report, see *Mech. Mag.* vol. xxv. p. 166.

The foregoing extract, which applies to water in a heated copper bowl, expresses with tolerable accuracy the phenomena resulting from water in a heated platinum crucible. Much, however, depends upon the quantity of water employed, and the surface upon which it falls. If the platinum crucible be large, and the bottom slightly convex within, the water on reaching the bottom divides into globules, each of which is a perfect sphere, and rotates with great rapidity upon its vertical axis, and at the same time it has a dancing, onward sort of motion. If the bottom of the crucible be quite flat, and be kept exactly horizontal, similar effects ensue; but the experiment succeeds best when the interior of the crucible is a portion of a hollow sphere, and the inner surface perfectly clean and bright. The water must fall in slow drops, or the surface of the metal will be wetted and steam generated, immediately such is the case; but if the former plan be adopted, there is, according to my view of the case, an atmosphere of steam immediately formed which surrounds the globule, prevents its contact with the heated metal, and so protects it from vaporisation.

These facts are remarkable enough, and it is no less remarkable that if the source of heat be removed, and the crucible allowed to cool for a few minutes, a portion of the water will suddenly burst into vapour and be dissipated immediately.

It will be seen, then, that as an excessively high temperature is unfavourable to the production of steam, so, by a converse analogy, water, if kept perfectly tranquil, may have its temperature lowered below zero without freezing. Neither of these facts has, I believe, received an adequate explanation. My present purpose is to confine myself to the former.

Rumford explained the phenomenon by supposing it "due to the reflection of caloric operating on the surface of the drops of water." Pouillet attributes it to another cause. He believes that "the calorific rays emanating from the vessel traverse the water *too easily* when they are very hot." These opinions are cited by Dumas (*Chimie Appliquée aux Arts*, vol. i. p. 32), who seems to feel their inadequacy, and there leaves the matter with the following advice:—

"However it may be, the fact is incontestable. It ought to caution us against the accidents which a steam-boiler is liable to produce when raised accidentally to a very high temperature, for it might happen that it ceases to furnish steam, and, nevertheless, a reduction of temperature would cause an explosion. Plates of fusible metal are above all things useful in preventing accidents of this kind, since they limit the temperature that can be obtained by the apparatus; for it is evident that a valve would not be raised at the moment when this singular phenomenon should display itself.

"This kind of accident must be uncommon with ordinary boilers, but it may become very frequent if the employment of generating tubes becomes more common. These tubes containing but small quantities of water, and being habitually raised to a very temperature, it would be easy to attain the very point at which this very phenomenon would ensue. But, in truth, accidents would be less serious on account of the small size of the apparatus."

If I understand this caution rightly, it appears that an explosion may happen somehow in the following manner:—A generating-tube is intensely heated, and

water passing into it in small quantities at a time is not converted into steam, on account of the too great heat; the engineman fancies the tubes are not hot enough, and adds fuel to the fire, which has the immediate effect of damping it; the temperature of the tubes is, consequently, lowered down to the point most favourable to the generation of steam—the water is suddenly converted into steam, and as the valve cannot allow so large a quantity to pass, the steam bursts the tube.

With great submission, it seems to me that M. Dumas' fears and advice are alike superfluous, because, if the platinum crucible (and this I take it is an analogous case) be not sufficiently heated, water thrown into it immediately boils, or cools the crucible down below the boiling point, and then the contained water boils in the ordinary way; and when once it does boil it never ceases until the whole is dissipated, however much we may endeavour to raise the temperature of the crucible during ebullition. Again, if the water be not added drop by drop, the effect cannot be produced, for a stream of water prevents the manifestation of the phenomenon in this way:—It wets the crucible, and consequently brings the water in contact with the heated metal, whose temperature is thus lowered, while that of the water is immediately raised to 212°, and ebullition commences. This can only be prevented by adding the water to the hot crucible in drops, by which means the crucible is not wetted, and the water is protected from contact with the hot metal by calorific repulsion, as well as by the atmosphere of vapour formed around the globule the moment it falls into the crucible. These cases, I think, apply to generating-tubes; in them, as in the crucible, when once the water begins to boil it does not cease until dissipated, provided heat is continued; and even supposing that the tubes contain no water, and are brought to a great heat, is it possible that the water is ever admitted in quantities so small as to produce the effect described? I think not; and if my supposition be correct, M. Dumas' advice is, as I have said, superfluous.

But it will be seen, that one case is reserved where an explosion is just possible—if the tubes be heated above redness, and water be admitted in very small quantities at a time so as not to wet and cool the tubes, then a reduction of temperature would cause a great rush of steam by bringing the water in contact with the heated surface. Now I would ask, Is this case possible?

The following series of experiments will give a general idea of the mode in which I have conducted this inquiry:—

A platinum crucible of two ounces capacity, goblet-shaped, and having at the bottom a portion not exceeding $\frac{1}{4}$ths of an inch in diameter quite flat, was chosen; this was boiled in sulphuric acid, then well washed in water, and boiled in pure water, so that it was quite clean and bright, and well adapted to the favourable display of the phenomenon. The crucible was placed in a black-lead furnace, surrounded by a wall of ignited charcoal, and intensely heated.

1. From a dropping-tube I filled the crucible with water about one-fourth, drop by drop. The water fell in with scarcely any audible sound; the drops collected into one large *button*, which was very convex, and resembled mercury in *form*; it moved with great rapidity, with the results before noticed. Its specific gravity must have been small, for minute portions of charcoal which fell in generally sunk through the water to the bottom of the vessel. The water remained in this state *seven minutes*, during which time it gradually decreased in bulk until the whole was gone. Several times when a fragment of charcoal did not sink it partook of the motion of the water, and described an equilateral triangle within the globule, touching its side three times during one revolution. When the crucible was removed from the furnace and allowed to cool, a burst of vapour ensued in about one minute and a quarter from the time of its removal, and more than one-fourth of the water was dissipated. This occasioned so great a loss of heat, that in a very few minutes the crucible and the remaining water could be handled.*

2. Pyroligneous ether boils at 150°. Allowed twenty drops to fall into the

* I have several times introduced the bulb of a thermometer into the water in the hot crucible, but I do not state the results because they must be fallacious, since correct indications cannot be had unless the whole of the mercury be inserted into the liquid whose apparent heat it notes; and, in the present case, the bulb alone was immersed, while the stem was submitted to a very fierce heat.

white-hot crucible. This substance is composed of hydrogen, oxygen, and carbon, and is very inflammable. In the crucible it presented phenomena similar to water, but began almost immediately to decompose; the gases passed off, and, after the lapse of several minutes, the carbon alone remained in the form of a perfectly spherical jet-black body—this in a few seconds split into several pieces, each piece became red-hot, and, combining with oxygen, passed off as carbonic acid gas.

3. Alcohol gave results somewhat similar.

4. Sulphuric ether boils at 96°. This was difficult to introduce into the hot crucible, on account of its great inflammability and volatility; but I managed to collect one large globule at the bottom of the crucible, which behaved tranquilly for a few minutes, quickly disappeared, and left no residue.

5. Oil of turpentine boils at 314°. This was introduced into the crucible, but it instantly decomposed and passed off in dense clouds of carbon and flame.

6. Oil of olives behaved in a similar manner.

7. Sulphuric acid (specific gravity, 1·852) was instantly decomposed, and filled my laboratory with clouds of sulphurous acid fumes.

8. Mercury boils at about 650°, and afforded interesting results; eight or nine globules were thrown into the hot crucible, considerable agitation ensued, which, however, soon ceased, and one large globule of the metal was collected at the bottom of the vessel; it turned slowly round upon a vertical axis from left to right for six or eight minutes, throwing off its vapour all the time, as was proved by holding a cold iron rod two or three inches above the crucible, which was covered with mercury to the height of more than two feet, in so minutely divided a state that it had lost all its metallic lustre, and appeared dull white. The glass through which I looked into the furnace was also completely covered with this white powder, so much so as to obstruct the view.

From these experiments it would seem that when a fluid is thrown, drop by drop, into a white-hot platinum crucible, evaporation or decomposition is quickest and greatest in proportion as the boiling point of the given liquid is high; because the heat necessary to convert such a liquid into vapour abstracts from the crucible so much, that the remaining heat leaves the crucible at a temperature most favourable to the generation of steam, or cools it to such a point that ebullition commences in the liquid that remains.

In another trial with mercury, and while it was rotating, I threw upon it about ten drops of water, which were instantly converted into steam; this shows the very different capacities of the two metals, platinum and mercury, for heat—for we have seen that the water may remain for seven or eight minutes in the hot platinum crucible, but when brought in contact with hot mercury it is immediately dissipated. In this experiment it is curious to note that the first drop of water stopped the rotation of the mercury, nor did it again rotate even after the ten drops of water had been dissipated.

I am very much inclined to think that the rotation of the mercury in the hot platinum crucible is due to thermo-electric currents, generated in this instance by the heating of two dissimilar metals in contact. A similar cause will, I think, explain the fact noticed by your talented correspondent, Colonel Maceroni, in a note appended to p. 23 of your last volume:—"Iron, silver, or copper, or any metal that requires a great heat to melt, being in a fluid state in active radiation, and in no greater quantity than will form a small globe or 'button' at the bottom of a crucible, being removed from the fire will be seen to be rapidly turning round like a top."*

But to return—it is necessary that a metal crucible be employed in these experiments (in a Hessian crucible the above liquids are instantly vaporised), and of all the metals platinum succeeds best, probably for two reasons:—1st. its small capacity for heat; 2d. its non-oxidable quality; for water contained in it is not decomposed so quickly as it would be were a more oxidable metal employed, there being little or no attraction between the oxygen of the water and the platinum.

I will now offer a few theoretical remarks on the phenomena I have attempted, thus imperfectly, to describe.

* I am now engaged on this subject, and in a future communication propose to consider this, together with about seven other supposed paradoxical rotations.—C. T.

It has been assumed, that because the platinum crucible is heated to whiteness, that its contents must also participate in the same high temperature; but I am by no means assured that such need be the case. One point is, I think, certain, that the globule is not in contact with the metal; but is repelled by the calorific rays, and partly protected and supported by an atmosphere of vapour, which is formed the instant the globule falls into the crucible; the water has a globular shape, and bears unequally upon the atmosphere of vapour which surrounds it, since bubbles of vapour are sometimes seen on one side only, resulting, probably, from a small portion of the under surface of the globule coming in contact with the heated metal—this would occasion an oscillation or undulatory movement throughout the mass, and produce an appearance of rotation. Now as water is a very bad conductor of heat, it is probable that the atmosphere of vapour has a temperature of 212°, while its contained globule is only 180° or 200°; this receives heat very slowly from the vapour, and so it is retained for some minutes in the liquid form. A reduction of temperature, by removing the crucible from the furnace, manifestly offers less repulsion from the sides and bottom of the crucible, and then, and then only, does the globule get into actual contact with the heated metal, when it is suddenly converted into steam and passes off. The reason why no evaporation is evident, must be explained by adopting the above assumption, that the globule is comparatively cool, and the vapour surrounding it is dissipated almost before it leaves the crucible, on account of the fierce heat by which it is surrounded.

Since the above was written, and within a few days only, a scientific friend who knew I had interested myself in this inquiry, sent me a recent Number of the *Annales de Chimie*, containing a paper by M. Auguste Laurent on this very subject. My results and opinions in some cases approximate to, and in others disagree with those contained in this paper, I will therefore extract somewhat largely from M. Laurent's memoir.

It appears that M. Baudrimont had published a memoir (which I have not been so fortunate as to see), wherein he arrived at opinions similar to mine, and thinks "that the water does not touch the red-hot crucible, and that it is supported by a stratum of vapour (*couche de vapeur*), so that its ebullition is impossible." The object of M. Laurent is to refute this theory, and to offer his own as the only true one. This is natural, and, perhaps, on that account, excusable; but I do think that if M. Laurent had been a little less positive, he would have appeared a little more "*aimable*." He endeavours to determine the temperature of the water in the hot crucible in a very ingenious manner:—

"I constructed a thermometer whose bulb was sufficiently small to be covered by two or three grammes of water which I introduced into the crucible. I enveloped its stem with a glass tube, which I supported at its lower part with a cork; between the stem and the tube I put cold water, and then plunged the bulb of the thermometer into the red-hot crucible: the mercury rose rapidly to 211° Fahr., where it remained stationary.

"A volume of water thrown drop by drop into the red-hot crucible surrounded by burning charcoal, does not wet the crucible, and occupies two minutes and a half to evaporate.

"A second volume of water thrown entire into the same crucible suddenly cools it in wetting it, and occupies only half a minute to evaporate.

"Thus the same volume of water evaporates five times quicker in the crucible, which is wetted and cooled, than in the crucible which remains red-hot: the whole difficulty then consists in explaining this difference in point of time.

"1. The crucible which is thus wetted and cooled by the water thrown suddenly into it must furnish more caloric than the one which remains red, and must produce a more rapid evaporation.

"2. In the red-hot crucible a very small surface of the water only touches the sides of the crucible, and even does not touch them continually; whilst in the cooled crucible a large surface is in contact: the wetted crucible then will lose by contact the caloric which it received more rapidly than the red-hot crucible will lose its caloric by radiation or by feeble contact; consequently the water must evaporate more rapidly in the one case than in the other.

"3. Part of the red heat in radiating traverses the water without being absorbed. I was convinced of this by casting into the red-hot crucible a volume of water slightly blackened with Indian ink; then it evaporates somewhat quicker than pure water.

"4. In the ordinary explanation of this phenomenon, it is supposed that the water does not touch the red-hot crucible, and that

it is supported by a bed of vapour, whence it is concluded that its ebullition is impossible. M. Baudrimont arrives according to his experiments at the same conclusion. But I am convinced that this is incorrect. I made the bottom of the crucible a little convex within, then red-hot, I put in water drop by drop; this entered into ebullition—the bubbles came principally from the centre, still it took two minutes and a half to evaporate.

"I placed within the crucible a very thin piece of platinum foil of the shape of a watch-glass; upon this I poured a volume of water; the foil was wetted and the water entered into ebullition, and, in spite of that, it took about two minutes and a half to evaporate."

The last three experiments, I confess, somewhat perplex me; the one marked 3. is unintelligible, and does not seem to warrant the deduction contained in the sentence; 4. contradicts my results when similar means were taken, for I had no ebullition, and the water within the crucible divided into spheres, each of which partook of the motion already described. This and the next experiment contradict M. Laurent's opening experiments with which I agree, and I also agree with the deduction, that when the water does *not wet* the hot crucible, evaporation is slow and imperceptible; and conversely, that when the water does wet the hot crucible, evaporation then is sudden and quick. I may add, too, that when water falls drop by drop into the hot crucible, evaporation is slower in proportion as the heat of the crucible is high, and *vice versâ*. This is how I explain the discrepancy as to time—in my experiments the water often remained seven or eight minutes, whereas M. Laurent gives 2½ minutes as the longest time, indeed as the only time, when the water was added drop by drop; but how he contrived this degree of exactness I cannot tell, for I have found as I have said, that the evaporation is quick or slow, according as the temperature is of less or greater intensity, and the same temperature cannot always be preserved. M. Laurent proceeds:—

"I now wish to *demonstrate* that the water does not continually touch the crucible, but that it dances like a billiard-ball, or a marble (bille), let fall upon a horizontal plane.

"I would also prove, that if the water does not moisten the red-hot crucible, it is not, as has been supposed, because it is supported by the vapour, for if it were so, the water would be violently and irregularly agitated, *and it is precisely the contrary which happens*; and besides, when the evaporation is slow the water does not wet the crucible, which it does when the evaporation is rapid."

I may here observe, that the water is "irregularly agitated;" but, admitting this, it does not follow that it is "*violently* agitated:" yet, certain it is, that the water often, in consequence of this "irregular agitation," spits drops out of the crucible to a considerable distance. I am not quite sure that the term "violent" does not apply.

"In examining attentively the water just thrown into a red-hot crucible placed quite vertically in the furnace, it is seen to take alternately many figures of the greatest regularity.

"Sometimes it presents itself under the form of a wheel with four teeth, or 6, 8, 10, 12, always in equal number.

"These singular figures can be well explained in admitting,

"1. That the water does not wet the crucible for the same reason that mercury does not wet glass.

"2. That the globule of water is submitted to a vibratory movement which varies at every instant, and that this movement is produced by the vapour which is formed below whenever the drop of water touches the crucible; the drop elevated by the vapour falls in order to be again elevated, and so on."

M. Laurent then explains the change of form in the globule by a theory which bears a great resemblance to one formed by me several months ago, "On the modes of vibration of glass goblets and the changes they undergo during vibration." As my theory was written in September last, and sent to the *Philosophical Magazine* the first week in November, and M. Laurent's paper was published at the end of November last, and received in England only within the past month, it will be seen that we were both unconsciously pursuing a similar train of thought upon my favourite subject, vibration. I trust this digression will be excused, as I am anxious to M. Laurent all due merit, and, at the same time, to prevent any inference discreditable to myself arising from the priority of publication, of which M. Laurent has the advantage. But, to resume his memoir,

"Let us suppose that an elastic circle is

compressed at two points exactly opposite, it will take the figure of an ellipse; but if the compressing cause suddenly ceases, the ellipse, by its elasticity, will become at first circular, then the flattened part will pass over the circle by virtue of its acquired swiftness, and will give a new ellipse whose major axis will be perpendicular to that of the first. The circle before returning to its first state of repose will give a series of ellipses alternately perpendicular, and if these motions are rapid enough, the two consecutive ellipses will appear to exist simultaneously, and we shall see a wheel with four teeth.

"Let us suppose the circle to be compressed in three points equally distant, it will take the form of fig. 2.* By its elasticity, it will regain its first circular state, then it will pass over and take a figure inverse to the preceding, and so on; these movements becoming very rapid, we shall see a figure with six teeth. It will be the same for the figures with 8, 10, 12 teeth.

"In order to prove that these figures are due to the repeated falling of the water upon the bottom of the crucible, I have imitated them with mercury in the following manner:—

"In a small hemispherical porcelain capsule I poured from 20 to 100 grammes of mercury, and placed the capsule upon an elastic ruler, which I vibrated strongly by means of a bow: the mercury immediately took the same figures as the water in the red-hot crucible; but with mercury the difficult figures succeed each other very rapidly."

I have already written more than enough to be tiresome, and will not occupy your valuable space with further extracts or comments—I therefore conclude with one remark. I complain of M. Laurent chiefly for being too imaginative—for seeing what he *wished* to see, rather than what he did see, and for straining after an analogy where scarcely any exists. He says that the globule of water in the red-hot crucible presents figures of the "greatest regularity." With the exception of the spherical drops already alluded to, I have not found this to be the case. I have often watched the contents of the crucible, and have no hesitation in saying that its form and behaviour is uncertain and fitful in a great degree, and bears no relation to the beautiful and certain results obtained by vibrating mercury.

I now leave your readers to discuss the questions I have raised. My great object in sending this paper to *you*, is, that it may be read by practical men; and if they can trace this phenomenon to steam generating-tubes, point out more clearly the cause, and obviate all its probable consequences, I shall feel no mean pleasure hereafter in referring to this time when I first appear as a correspondent in your Journal.

Your very obedient servant,

CHARLES TOMLINSON.

Salisbury, Jan. 2, 1837.

* In the Number of the "Annales" that I am translating from, there are no figures given; but in this case, it will be readily seen, that figure 2, referred to, must be somewhat that of a *heart*.

PRODUCTION OF ANIMALS BY GALVANISM—MR. CROSSE'S EXPLANATION.

(To the Editor of the Taunton Courier.)

Dear Sir,—Having seen in a very recent publication what is stated to be an account of some experiment of mine, in which insects were produced instead of crystals, I take the earliest opportunity of making known, that such an account was published without my knowledge, and, *that although the main fact is as there represented*, yet that the mode of conducting such experiments is inaccurate. I am the more anxious to correct this statement, as several perfectly erroneous accounts have already appeared in different papers, calculated to produce a false impression in the minds of all but scientific men, who can, if they please, readily distinguish an error when they meet with one.

I am sorry to observe that a gentleman of high repute (Dr. Ritchie), who seems to have forgotten both science and temper on the present occasion, has taken advantage of some such misstatements to form the weak foundation for a most illiberal attack upon me in the *Literary Gazette*, which I shall take an early opportunity of replying to as it deserves.

I must further request my friends and the public not to give credit to any publication as coming from me unless my name is attached; and as I detest nothing so much as a literary or scientific dispute, I had hoped to have glided through the remainder of my life without provoking the malevolence of the ill-disposed, and more particularly as I am unconscious of having done any thing to offend the most captious by presumption or misrepresentation.

I beg to remain, dear Sir, yours truly,

A. CROSSE.

Broomfield, Jan. 3.

CANALS AND RAILROADS IN THE UNITED STATES.

(From the Philadelphia Commercial List.)

Sir,—The following table, compiled principally from the *American Almanac, and Repository of Useful Knowledge*, for 1837, is believed to be essentially correct, and displays an extent of enterprise and capital unequalled at any former period by any country in the world. I send it for publication without offering any comment. It exhibits the gigantic resources of our country in a new and condensed form, and will prove interesting to all classes of the community, whether *rich* or *poor*.

A True Friend to Internal Improvements.

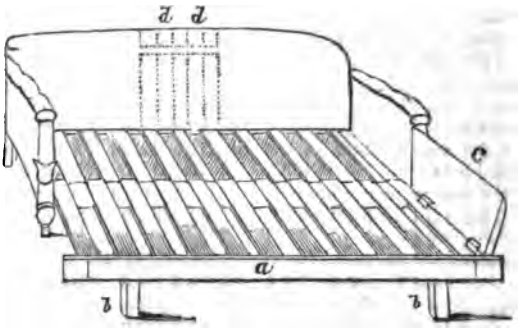
STATES.	CANALS. No. of Canals.	CANALS. Made. Miles.	CANALS. Made. Cost Doll.	CANALS. In progress. Miles.	CANALS. In progress. Cost Doll.	RAILROADS. No. of Roads.	RAILROADS. Made. Miles.	RAILROADS. Made. Cost Doll.	RAILROADS. In progress. Miles.	RAILROADS. In progress. Cost Doll.	RAILROADS. Projected. Miles.	RAILROADS. Projected. Cost Doll.	Total Canals and Railroads making and projected. Miles.	Total Canals and Railroads making and projected. Cost Doll.	Grand Total of Canals and Railroads, made, making, &c. Miles.	Grand Total of Canals and Railroads, made, making, &c. Cost Doll.
Maine						4	10	200,000			416	3,663,500	416	3,663,500	416	3,663,500
New Hampshire						1			15	300,000			15	300,000	15	300,000
Vermont						4					400	4,000,000	400	4,000,000	400	4,000,000
Massachusetts	4	99	1,528,000			16	117	4,401,454	205	6,150,000	183	3,920,000	388	10,070,000	604	15,999,454
Rhode Island	2	27	490,000			2			40	1,200,000	10	300,000	50	1,500,000	77	1,990,000
Connecticut						3			90	2,700,000			90	2,700,000	90	2,700,000
New York	18	767	13,884,382	369	21,988,726*	93	175	3,500,000	1557	31,155,000	906	18,433,000	2832	71,576,726	3774	88,961,108
New Jersey	3	172	5,560,000			7	108	2,960,000	87	1,705,000	75	1,500,000	162	3,205,000	442	11,725,000
Pennsylvania	15	839	21,601,325	469	14,790,000	43	451	13,874,068	817	15,235,000	1178	22,085,000	2464	52,110,000	3754	87,585,000
Delaware, 1	1	13½	2,200,000												13½	2,200,000
Maryland, 2	2	10	200,000	341	10,280,000	4	139	4,366,507	274	6,850,000	1089	21,780,000	1704	38,860,000	1844	43,366,507
Virginia	19	42	1,119,061	591	5,202,765	24	102	1,176,103	153	1,535,000	1260	12,595,000	1914	20,332,765	2558	22,628,929
North Carolina	3	23	460,000			5					1008	15,120,000	1008	15,120,000	1031	15,580,000
South Carolina, 3						3	136	2,040,000	100	1,500,000	607	12,140,000	707	13,640,000	843	15,680,000
Georgia	1	16	165,000	60	1,800,000	7			429	5,435,000	308	3,570,000	797	10,805,000	313	10,970,000
Alabama	2			53	1,990,000	8			46	690,000	985	16,075,000	1084	18,655,000	1084	18,655,000
Mississippi						4			178	1,320,000	51	765,000	229	2,085,000	229	2,085,000
Louisiana						3	5	80,000	560	11,200,000	6	120,000	566	11,320,000	566	11,320,000
Tennessee, 4																
Kentucky	3			560	12,800,000	3	30½	920,000	60	1,200,000	56	660,305	676	14,660,305	706	15,580,305
Ohio	17	405	7,546,000	575	9,145,342	41			289	4,739,000	2380	27,005,000	3244	40,889,342	3649	48,435,342
Indiana	3			463	6,200,000	3					253	2,650,000	716	8,850,000	716	8,850,000
Illinois, 5	1			93	7,000,000	13					1760	17,250,000	1855	24,250,000	1855	24,250,000
Missouri						2					200	2,500,000	200	2,500,000	200	2,500,000
District of Columbia	2	8½														
Florida, 6																
Total	87	2422	58.753,768	3486	92,046,833	293	1235	33,468,132	4900	92,914,000	13,131	187,231,805	21,517	371,092,638	25,179	459,025,145

1. The Railroad passing through this State is included in Pennsylvania.—2. About 60 miles of the Chesapeake and Ohio Canal are completed, being up to Harper's Ferry; and the proposed Railroad of 1089 miles, put down to this State, extends from Baltimore to New Orleans.—3. This includes the projected Railroad from Charleston to Cincinnati.—4. The Railroad from Nashville to New Orleans, going through this State, is included in Louisiana.—5. Illinois has a remarkably heavy rock excavation.—6. Florida has incorporated several Railroad Companies, but they are not sufficiently described to determine their magnitude.—* This sum includes enlarging the Erie Canal, now in progress.

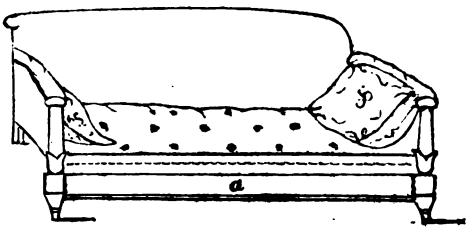
Note.—This table is, without doubt, much within bounds, as a number of Railroad Incorporations noticed in the Repository, by name, I was unable to trace to full satisfaction on the maps, and have omitted them.

EXPANDING SOFA-BEDSTEAD.

Fig. 1.



2.



Sir,—The following is a description of an expanding sofa-bedstead adapted for small apartments, which you will perhaps think worthy a place in your valuable Magazine. Fig. 2, sofa about 6 ft. 3 in. long by 2 ft. 6 in. wide; *a*, front rail to draw out (instead of turning up). Fig. 1, the sofa drawn out into a bedstead; *b b*, two legs hinged to drop; *c*, a thin head-board to turn up when the bedstead is expanded; *d d d*, three of the seat-laths turned up, opening to a *shallow* well for blankets, sheets, and quilt; the seat-cushion is made to fold in two parts, which form the mattrass for bedstead, and will be when opened 4 feet 3 inches wide.

A MECHANIC.

THE FIRST RUSSIAN RAILWAY.

The history of the railway from St. Petersburgh to Zarskoeselo and Pawlowsk, which is by this time in operation, presents several remarkable points of contrast with similar works in England, which throw considerable light on the relative situations of the two countries. In England, all the railways executed and projected have a view to the promotion of trade, or the public convenience. In Russia, this, their first railway, is composed of two branches, running from the capital, one to the imperial residence of Zarskoeselo, and the other to the middle of the park of the Grand Duke Michael. In England, the speculators would have had to go through an infinity of trouble and expense to procure an "Act"—in Russia all this roundabout process was avoided; as soon as the Emperor took the concern under his patronage, all difficulties vanished; an imperial ukase directed the immediate cession of all private lands on the line to the Company (compensation to be an after consideration), and conferred the privilege of carrying the railroad for a whole mile through the most crowded

streets of the metropolis, without troubling the "corporation of St. Petersburgh" for their consent. By the same means the Company were freed, for the first ten years, from what is *here* a pretty considerable nuisance—the payment of rates and taxes. The will of the Autocrat, however, was not sufficiently powerful to produce an effect which would have happened naturally enough in England—the manufacture of the railway and its appliances by "native talent." As a matter of course, the whole were imported from England; the rails from the Butterley and Bedlington Iron-works and the Welsh furnaces of Messrs. Guest, Lewis, and Co., and the pedestals from Butterley only. The locomotive-carriages were furnished by Mr. Stephenson, of Newcastle, Mr. Hackworth, of New Shildon, and Mr. Tayleur, of Warrington; their only foreign competitor, too, was foreign in residence alone—Mr. Cockerill, the English iron-master of Liege, in Belgium. Some of the English locomotives were tried on railways here before being shipped for their destination, and, if report can be relied on, went at the rate of 75 miles an hour! The only party not English about the concern appears to have been the chief engineer, Von Gerstner, a German—and *he* received his railway-education in this country, which he visited on purpose. Every article of mechanism required came ready-made from England:—the weighing-machines were supplied by Mr. Kitchen, of Warrington; a crane, by Sharp and Roberts, of Manchester; clocks, with illuminated dials (in the style of our first-rate gin-shops), by Mr. Paine, of London; and even the "trumpet-machines," which the Company are compelled to use, to give notice of the approach of their carriages when traversing the streets of St. Petersburgh, were manufactured in our own metropolis, by Messrs. Robson and Son. Each carriage is also provided with an apparatus (which will not be without its use in such a climate as that of Russia) for removing frozen sleet and snow from the rails.

The railway is 18 miles in length, that is, the Pawlowsk branch, which was the first undertaken. It terminates in the centre of the Grand Duke's park, where the Company have erected a large building as a house of entertainment, their principal dependance for remuneration being on the holiday-makers of St. Petersburgh, who, they calculate, somewhat in the fashion of similar speculators nearer home, will pass along it at the rate of 1,500,000*l.* per annum, though their expectations of a profit of 13 per cent. on their capital of 3,000,000 rubles (135,000*l.*) are based on the supposition that no more than 300,000 will make use of their conveyances. At present it is reckoned that the number of horses employed in keeping up the communication is 178,187 in the year. The time required to perform the distance on the railway will be half an hour only, and the (lowest) fare half a ruble; while the diligence takes from two to three hours, and charges three rubles. The works were commenced in April, and the first line was expected to be finished in six or seven months, as, with the powerful patronage of the Czar, physical obstacles were the only ones that had to be encountered.

PERPETUAL MOTION.

Sir,—I was much surprised, on looking through your 696th Number, to see that any one else should have been induced to make an attempt at perpetual motion on Mr. Mackintosh's plan, as shown at p. 149, when it must be plain to every one, that gravity, the very power which was intended to give motion to the wheel, is completely neutralised by the power of the magnet; and that the backward motion described by Mr. Mackintosh, and verified by Mr. Monro (see p. 192), proves nothing more than that the friction between the ball and the wheel was greater than the friction on the axle of the wheel. The suggestion of the ratchet, to prevent the said retrograde movement, was certainly good, as proved on its application by Mr. Monro; but I am at a loss to understand how any one having the slightest smattering of mechanical knowledge, could imagine it should have any tendency to reverse the only motion produced. But I should say, the most extraordinary part of the affair is, that a rational being could be led, by the failure of so futile an attempt, to conclude that *gravity*, in the hands of the great Creator, is insufficient to produce *that*, which he (Mr. Mackintosh) in his experiment had taken most effectual means to prevent.

Yours, &c. TREBOR VALENTINE.

PROPELLING VESSELS BY AIR—CLOCK ON A NEW PRINCIPLE.

Sir,—Now that I am driven from my workshop (which is, in fact, a summer-house, and very damp) by the severe weather, I cannot help taking my pen, as a substitute for more laborious employment, to tell of what I have been about the past summer. My first experiment was the method of propelling a boat I mentioned in my letter in No. 670 of the *Mechanics' Magazine;* and although the comparative velocity was small to what I have obtained by various kinds of paddle-wheels, I think the plan applicable to purposes of war and canals. To explain—I made a boat, three feet long, seven inches wide, and placed in the fore part a pair of single bellows (they should be double)—but I did not fit an air-vessel, as I ought to have done, so as to prevent the return of water up the vent-hole or bellows-pipe. To this I fitted a train of levers, cranks, and wheels, with a moderate clock-spring; the vent-hole passed at an angle of about 20° through the bottom of the boat, near the centre of gravity, and blew into an enclosed column of water, open a-head and a-stern. This produced motion, but instead of one vent-hole there should have been many, with a constant power like steam. What it may become is impossible to say, but I should like to try further. My next idea was a kind of clock different from any hitherto attempted, and so made as not to be affected by either temperature or humidity; and to prove this last idea, I made a hygrometer which involved the principle of my clock. I constructed a very delicate brass balance, with scale of degrees below; and on one end of the balance I put a disc of wood, painted, varnished, and double-gilt—on the other end I placed another disc of the same wood, quite plain. I then adjusted the balance parallel with the index of my whalebone hygrometer, four feet long, and they have ranged parallel ever since, only the balance is the most sensible of the two. My clock is made without pendulum or spring; in fact, I make the going-weight lift alternately a small counter-weight attached to a beam at one end, and the pulley or the balance-wheel is fastened to the other end of the beam by means of a horse-hair. Balance-wheel and pulley are of wood, painted, varnished, and double-gilt; the balance is only three inches in diameter, the going-weight 40lbs.—but the escapement is too large, it is detached. I have no means of obtaining correct mean time, but my clock goes well with a pocket-chronometer. I am now engaged with a small power-engine on a new principle, more powerful and more portable than steam. If any of your readers wish for the fastest thing in the way of paddle-wheels, quite new, I can satisfy them.

Your constant reader,

KEENAMS.

MANUFACTURE OF IRON.

Sir,—Is it not very surprising that a matter of such vital importance to the whole mechanical world as the manufacture of iron should have been so little discussed in your pages?—certainly we had a very full account of the saving effected by the use of the hot-blast, and which was broadly stated at the same time to improve the quality as well as the quantity of metal so manufactured; but it was also stated that the quality of the said metal was much deteriorated: now one of these statements must, of course, be untrue, and one of your correspondents, Mr. Glynn, of the Butterley Iron-Works, I think, volunteered to furnish some samples, by which the question was to have been decided by you. Nothing having transpired for so great a length of time, I beg leave to ask whether it arises from any remissness on your part? and, at the same time, once more to call the attention of all whom it may concern, with this additional fact, which can only be taken as an acknowledgment of the inferiority of hot-blast iron; viz. the holders of metal manufactured by the cold-blast, now regularly demand 20s. per ton extra for it.

Yours respectfully,

TREBOR VALENTINE.

THE LAW OF BUILDING COMPANIES.

[Building Companies are great favourites with mechanics—those of country towns especially — and we think deservedly so. When prudently and honestly managed, they furnish great facilities for the conversion of the savings of industry into real estate. It cannot, therefore, be made too generally known, that by a recent statute the same legisla-

tive protection (nearly) has been wisely extended to all societies of this description, established prior to the 1st of June last, as is enjoyed by Friendly Societies. The following exposition of the new law on the subject we extract from Mr. Wordsworth's "Law of Joint Stock Companies" (2d Edition, 1837)—a most instructive and useful work, which no society or club of mechanics, associated for pecuniary objects, should be without. —Ed. M.M.]

"From the preamble of the statute* it appears, that certain societies, called Building Societies, have been established in different parts of the kingdom, principally amongst the industrious classes, for the purpose of raising, by small periodical subscriptions, a fund to assist the members thereof, in obtaining a small freehold or leasehold property. Accordingly, the Legislature have thought it expedient to afford encouragement and protection to such societies, and to the property obtained therewith. And they have enacted, that any number of persons may form themselves into societies for the purpose of raising a fund by monthly or other subscriptions of the several members. Shares not exceeding the value of 150*l.* for each share, such subscriptions not to exceed in the whole 20s. per month for each share. The object of this fund is to enable each member to erect or purchase a house; but the same is to be considered as mortgaged to the Company until the amount of the member's share shall have been fully repaid to such society with interest, &c. The members may assemble together and make such rules for their guidance as the majority may think proper, provided they are not repugnant to the present enactment, and the general laws of the realm. A power is given to inflict fines upon the members if they contravene the rules. It is prescribed that no interest or dividend shall be paid upon any shares, until the amount or value shall have been realised, except in the event of a member withdrawing himself.†

"The society may receive from its members money by way of bonus for the privilege of receiving the amount of value of the share prior to its being realised, and also the interest on such share so received, without being subject to the usury laws.‡

"The rules may prescribe forms of conveyance, mortgage, transfer, agreement, bond, or other instrument, provided the forms be inserted in a schedule to the rules, and duly certified and deposited.§

"The provisions of the Friendly Societies' Acts, 10 Geo. IV. c. 56, and 4 and 5 Will. IV. c. 40, are extended to this Act, so far as any part thereof may be applicable to building societies, and to the framing, certifying, enrolling, and altering the rules, in such and the same manner as if such Friendly Societies' Acts had been expressly enacted in the present statute.‖

"The trustees named in any mortgage made on behalf of the society, may endorse thereon, or upon any other instrument given, a receipt for monies intended to be secured by such mortgage, &c., which shall be sufficient to vacate the same, and vest the estate in the property comprised in such security in the person, for the time being, entitled to the equity of redemption, thereby dispensing with the necessity of conveyance.¶

"No building society can, however, vest any part of its funds in the Savings' Bank, or with the Commissioners for the reduction of the National Debt.**

"Nor is any society entitled to the benefit of this enactment, unless its rules be certified and deposited as directed by the Friendly Societies' Acts.†† Finally, under the 8th section, an exemption is given from the operation of the Stamp Duties."

* 6 and 7 Will. IV., c. 32, App., p. 51.
† Sec. 1. ‡ Sec. 2. § Sec. 3.
‖ Sec. 4. ¶ Sec. 5. ** Sec. 6. †† Sec. 7.

CANAL IMPROVEMENTS.

Sir,—In Number 672 of your truly valuable Journal, there is a scheme suggested by the Rev. Dr. Carey, of Clonmel, for working canal-locks, *without any loss of water*; or rather a description of a new lock for that purpose, relative to which, with your permission, I will make one or two remarks.

From the rather unintelligible description which is given of it, I suppose we cannot err by concluding, that the process consists of nothing less than raising the water from the lower to the upper level, by exhausting the air from the basin of the lock, by means of the sheet-iron chamber and air-pump there mentioned; in fact, pumping the water from one level into the other. If this conclusion be correct, I have not the least hesitation in pronouncing it a chimerical project altogether, and one which can never be rendered of the least practical use. For if we only consider the great extent of exhaustion which would be requisite, that of itself would be a sufficient objection; and the simple ques-

tion following must admit of a more easy solution than can now be given to it, viz. with how small a force, and in how short a space of time, can we get rid of nine or ten thousand cubic feet of air? Further, the clumsiness of the chamber which is mentioned as requisite for that purpose, to say nothing of the expense, must be one more great objection; and it requires but a very small portion of common sense to perceive, that in practice, something rather more substantial than sheet-iron would be requisite.

If I have taken a wrong view of the matter, I hope Mr. Carey will not neglect to put me right, as the subject is a very important one: had he favoured us with a slight sketch, all obscurity would have been done away.

The adoption of Mr. Wharton's plan of towing boats through canal tunnels, described in No. 675 of the *Mechanics' Magazine*, would necessarily be attended with enormous expense; for should the traffic be any thing like considerable, it would be requisite for some five or six engines to be always in readiness at each end of the tunnel; to take in tow the boats as they successively come; whereas, one stationary engine of sufficient power would answer every purpose; and, likewise, would not be the means of adding to the impure gas carried into the tunnel, unavoidably disengaged during combustion.

I am, Sir, truly yours,

J. L.

Clayton, Jan. 16, 1837.

VENTILATION OF APARTMENTS.

Sir,—I wish to offer a few remarks on the subject of a plan by which the foul and unwholesome air which is generated in sitting-rooms may be immediately carried off, and a constant supply of fresh atmospheric air insured. As rooms are at present built, it is quite clear that the only portion of air in them which can undergo any change is that towards the lower part—in fact, not extending above the chimney-piece. When the doors and windows are closed, the only current is up the chimney, and that current acts upon the lower stratum of air alone, leaving all the upper surface, which is foul and unwholesome, hanging from the ceiling like an infectious cloud, and so low down as to be inhaled by those who are present. The heated air which rises towards the ceiling has no means of escape; it there hangs confined without being at all influenced by the under current up the chimney. It appears to me that this evil may be easily overcome by simply making an opening into the chimney at the upper part towards the ceiling, by which you will immediately cause an upper current into it, in consequence of the partial vacuum produced by the heat from the fire. By this plan you ensure two constant currents of air in a room, extending their influence to every part of it, causing that which is breathed to be not only more refreshing, but much more wholesome. I propose to have this opening which I speak of so formed, that it may, in fact, be very ornamental. A square or circle, for instance, of two feet diameter, the interior being composed of a description of open or trellis-work, representing some tasteful design. It might be so arranged as to be capable of being closed when required. The smell arising from a half-extinguished lamp would after rising towards the ceiling be received into this upper current, and immediately carried away through the trellis-work up the chimney; so also all the hot air, the exhalations from the dinner-table, and all others of a noxious quality, would after rising upwards be carried off, and give place to a fresh supply. That this effect would be produced is quite clear; and it would, if adopted, tend, no doubt, to the comfort as well as the health of all, particularly of those who spend much of their time in doors.

If you think proper to give these suggestions a place in your Magazine, I may trouble you with some further ideas connected with the same subject, which, at any rate, is worthy some attention, as it relates to the health and comfort of the whole mass of society.

There is another advantage which would accompany this double current of air—that of preventing any chimney smoking. The united power of the two upward currents would have the effect of resisting the force of any single current whose inclination would be to descend.

I am, Sir, yours, &c.

M. C.

LIST OF ENGLISH PATENTS, GRANTED BETWEEN THE 25TH OF DECEMBER, 1836, AND THE 27TH OF JANUARY, 1837.

Hamer Stansfeld, of Leeds, York, merchant, for an invention, being the application to certain machinery of a tappet and lever action to produce a vertical or horizontal movement through the medium of ropes or bands working over, under, or round pulleys; being a communication from a foreigner residing abroad. Dec. 30; six months to specify.

William Cooper, of Picardy-place, Edinburgh, glass-merchant and stained glass-manufacturer, for an improved method of executing ornaments, devices, colours, or stains on glass. Jan. 10; six months.

Robert Griffiths, of Smethwick, Birmingham, machine-maker, and Samuel Evers, of Cradley Iron-Works, Stafford, iron-manufacturer, for improvements in the manufacture of burrs or nuts for screws. Jan. 11; six months.

Henry Adcock, of Summer-hill-terrace, Birmingham, engineer, for certain improvements in the construction of the furnaces employed in the reduction of iron-ores and other metallic ores, as also in some of the processes of the iron manufacture of other metals, such furnaces being applicable to other purposes. Jan. 11; six months.

James Gardner, of Banbury, Oxford, ironmonger, for certain improvements in cutting Swedish and other turnips, mangel-wurzel, and other roots used as food for sheep, horned cattle, and other animals. Jan. 11; six months.

Charles Sheridan, of Ironmonger-lane, London, chemist, for improvements in the manufacture of soda. Jan. 11; six months.

John Paul Neumann, of 81, Great Tower-street, London, prussiate of potash-maker, for improvements in the manufacture of prussiate of potash and prussiate of soda; being a communication from a foreigner residing abroad. Jan. 11; six months.

George Goodlet, of Leith, Edinburgh, merchant, for a new and improved mode of distilling from wash and other articles; also applicable to general purposes of rectifying, boiling, and evaporating or concentrating. Jan. 11; six months.

Francis Gybbon Spilsbury, of Newman-street, Oxford-street, Middlesex, engineer, and **William Maugham**, of Newport-street, Lambeth, Surrey, chemist, for certain improvements in the manufacture of carbonate of soda. Jan. 11; six months.

John Macneill, of Parliament-street, Middlesex, civil engineer, for improvements in making or mending turnpike or common roads. Jan. 11; six months.

James Braby, of Duke-street, Stamford-street, Lambeth, Surrey, wheelwright and coach-maker, for certain improvements in the construction of carriages. Jan. 11; six months.

Robert Sewell, of Carrington, Basford, Nottingham, lace-manufacturer, for certain improvements in the manufacture of white lead. Jan. 11; six months.

Charles Thornton Coathupe, of Wraxhall, Somerset, glass-manufacturer, for certain improvements in the manufacture of certain descriptions of glass. Jan. 11; six months.

John Gall, of Aberdeen, carpenter and builder, for an improved mode of priming fire-arms, applicable to percussion locks. Jan. 17; six months.

F. Arthur Dunn, of No. 22, Nelson-street, City-road, Middlesex, manufacturing chemist, for an improved mode of dissolving silicious matter and compounds of silica, and of manufacturing soap. Jan. 17; six months.

William Gossage, of Stoke Prior, Worcester, chemist, for certain improvements in manufacturing oxide of lead, applicable to making paints and other purposes; also certain improvements in the process of bleaching and purifying oils suitable for mixing paints and other oils and fatty matters. Jan. 19; six months.

John Murray, of Fitzroy-square, Middlesex, gentleman, for certain improvements in the construction of carriages. Jan. 19; six months.

Moses Poole, of Lincoln's-Inn, Middlesex, gentleman, for certain improvements in ordnance and other fire-arms; being a communication from a foreigner residing abroad. Jan. 19; six months.

Henry Needham Scrope Shrapnell, of Bayswater-terrace, Middlesex, esquire, for certain improvements on snuffers. Jan. 19; six months.

William Stedman Gillett, of Guildford-street, Middlesex, gentleman, for improvements in trimming and facilitating the progress of vessels in water. Jan. 21; six months.

Julius Oliver, of Castle-street, Falcon-square, London, gentleman, for a certain improvement in the filters employed in sugar-refining; being a communication from a foreigner residing abroad. Jan. 24; six months.

Joshua Cuttel, of Hollingforth, near Huddersfield, Yorkshire, woollen-manufacturer, for improvements in producing slubbings of and in spinning wool; being a communication from a foreigner residing abroad. Jan. 26; six months.

LIST OF SCOTCH PATENTS, GRANTED BETWEEN THE 21ST OF DECEMBER, 1836, AND 21ST OF JANUARY, 1837.

John Burns Smith, of Salford, Lancaster, cotton-spinner, for certain improvements in the machinery for roving, spinning, and twisting cotton and other fibrous substances. Sealed Dec. 24.

John Roberts, of Prestolle, Prestwick, Lancaster, calico-printer, for certain improvements in the art of block-printing. Dec. 28.

William Neale Clay, of West Bromwich, Stafford, manufacturing chemist, for improvements in the manufacture of sulphate of soda. Dec. 28.

James White, of Lambeth, Surrey, engineer, for certain improvements on railways. Dec. 31.

Baron Henry de Bode, Major-General in the Russian Service, of the Edgeware-road, for improvements in capstans. Dec. 31.

William Sharpe, of Glasgow, merchant, for a certain improvement in the treatment of cotton-wool in preparation for manufacturing the same into yarn and thread. Jan. 4, 1837.

William Cooper, glass-merchant and stained-glass-manufacturer, of Picardy-place, Edinburgh, for an improved method of executing ornaments, devices, colours, or stains on glass. Jan. 12.

Hamer Stansfeld, of Leeds, merchant, in consequence of a communication received by him from Christian William Schonherr, of Schneeberg, Saxony, for certain improvements in machinery for weaving, one of which improvements is applicable to other purposes. Jan. 13.

Thomas Vaux, of Wordford-bridge, Wordford, Essex, land-surveyor, for a certain mode of constructing and applying a revolving-harrow for agricultural purposes. Jan. 14.

Charles Thornton Coathupe, of Wraxall, Somerset, glass-manufacturer, for certain improvements in the manufacture of certain descriptions of glass. Jan. 18.

John Ruthven, of Edinburgh, for an improvement in the formation of rails or rods for making railways, and in the method of fixing or joining them. Jan. 20.

NOTES AND NOTICES.

The Patent-office at Washington, in which were deposited models of all the machinery invented (or, at least, patented,) in America during the last fifty years, has just been destroyed by fire, and with it an almost innumerable array of specimens of the ingenuity of Brother Jonathan. Our Transatlantic brethren appear to pay even less attention to precautions against the ravages of fire than ourselves, and we are often culpably remiss in that particular. The present calamity originated in the Post-office, which is described as a wooden building, particularly liable to take fire, and the lower parts of which were used as a magazine of fuel. The flames spread from here to the adjacent Patent-office, a building of the same description, and the consequence is, that the records of American invention are swept from the face of the earth,—the immense collection of patent-models is entirely destroyed. Amongst them were many, no doubt, whose value was less than nothing; but among them also were some, the loss of which can never be repaired. From paragraphs in some of the recent American papers, it would seem that the fire was the work of an incendiary. However that may be, the Government of the United States have a heavy charge to settle with the inventors of the United States, for keeping the models which the law exacts from them as evidence of their ingenuity, in such a tinder-box as their Patent-office must have been. The *American Railroad Journal* of the 24th December, which we have just received, after narrating the occurrence, remarks, with respect to the models, drawings, &c. destroyed, "Certainly much useless lumber is removed, for which regret in the slightest degree cannot be felt." With this opinion we must say we perfectly coincide, and so we imagine will our readers, if they have read the abstracts of American specifications given from time to time in the *Mechanics' Magazine*—which are only about one in ten of the number—and the best of the lot. We are in hopes of better things from Brother Jonathan under the administration of the new Patent Law.

Death of Professor Farish.—By the death of this gentleman, the University of Cambridge has lost a great ornament, and mechanical science an able cultivator. Since his appointment to the Jacksonian Professorship, he had done much to popularise practical science in the University, and his lectures, we believe, were constantly well attended:—they were illustrated by a vast mass of apparatus and models of working machinery. The Professor, it will be recollected, was the chief instrument in the introduction of Isometrical Perspective to general use in this country.

Sir John Soane.—By the death of the venerable Professor of Architecture, it is understood that his house in Lincoln's Inn-fields, and its contents, become vested in the nation. The particulars of this munificent bequest must be fresh in the recollection of the readers of the *Mechanics' Magazine*.

Steam-Carriages on Common Roads.—We understand that Mr. Gurney has built two new steam-carriages—with other people's money, of course—but that he refuses to run them unless sufficient cash be advanced to build a third, which the moneyparties decline doing. A joint concern of all the steam-carriage patentees has been attempted to be got together for the purpose of uniting their resources for the working of the various common-road steamers. The gentleman who has made the most successful experiments has, however, declined being included in such a junction.

Mails on the Greenwich Railway.—A contract has, it is stated, been entered into between the General Post-office and the London and Greenwich Railway Company, for the conveyance of an "additional" post-office bag, thus conferring on the borough of Greenwich the first-fruits of the new and rapid mode of communication by railways.

Architectural Boards.—In Spain no public building, however insignificant, is allowed to be erected in any provincial town until the design has been submitted to the Academy of St. Ferdinand, at Madrid, which comprises the first architects in the kingdom. The object is to prevent the execution of any deformity at the public expense. In Sweden, a similar law for a similar purpose was introduced by Gustavus the Third, and the Board of Architects, to whom he confided the care of the public edifices, received and criticised also, if requested, the plan of any important private building, often making improvements, and, in some cases, presenting an entirely new design to the applicant. The German traveller, Eck, declares the consequence to have been a singular and striking elegance in all public and private buildings of note, erected during his reign.

Sugar from Chestnuts.—The manufacture of sugar from chestnuts, says the *Bons Sens*, will probably soon become an object of as much importance as that from beet-root. Some processes of extraction have already yielded 14 per cent., which is more than equal to the average produce of the beet-root.

"A Friend to Steam-Navigation to India" shall have due attention in our next.

Errata in the Review of the British Museum Report in our last.—Page 292, line 10, for "or Horsfield," read "Dr. Horsfield."

Page 295, line 4, of paragraph 19, after "15 days in the year," read "besides Sundays."

The Supplement to Vol. XXV., containing Title, Table of Contents, Index, and Plate of Specimens of English Medallic Engraving by Mr. Bate, was published on the 1st of December, price 6d.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

A complete list of Patents from the earliest period (15 Car. II. 1675,) to the present time may be examined. Fee 2s. 6d.; Clients, gratis.

Patent Agency Office,
Peterborough-court, Fleet-street.

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THE NEW COINING-PRESS OF THE UNITED STATES MINT, PHILADELPHIA.

Fig. 1.

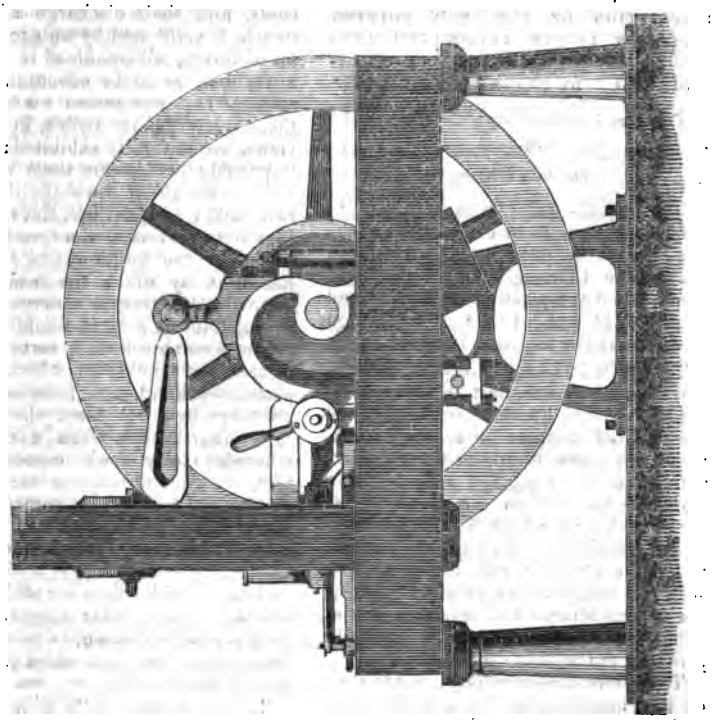
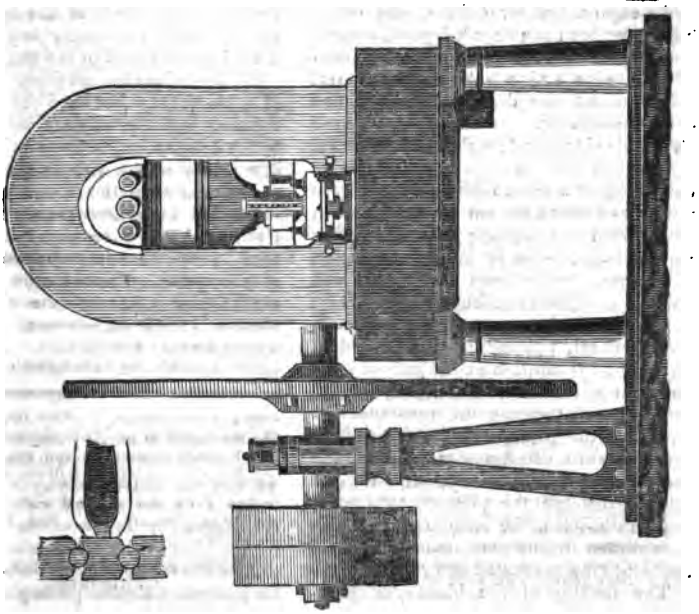


Fig. 2.



DESCRIPTION OF THE NEW COINING PRESSES LATELY INTRODUCED INTO THE UNITED STATES MINT, PHILADELPHIA. BY FRANKLIN PEALE, ESQ.

(From the *Franklin Journal for November.*)

To the Committee of the Franklin Institute, on Publications.

Gentlemen,—After seven months of experience, it will not be considered premature, to send for publication, a brief notice of the Coining Press, a model of which I had the pleasure to exhibit and describe, at one of the Conversation Meetings at the Institute last year.

This press has been in operation since the 23rd of March, last, the period of the first coinage by steam in the Mint of the United States; and the results, which are more than satisfactory, have authorised us to proceed with the most perfect confidence in the formation of the presses for the branch Mints at New Orleans, and at Charlotte and Dahlonega, in North Carolina and Georgia; also, with the manufacture of others for the use of this Mint, all of which, it is probable, will be completed at an early period in the coming year.

The above design exhibits a side view of the medium-size press, intended to strike eagles, quarter dollars, and cents. Three grades have been adopted, corresponding in linear proportions to the numbers of nine and a half, seven and six, suited to all the denominations of our coin respectively.

The side view (fig. 1.) exhibits the general proportions and arrangements of parts, consisting of a shaft with a fast and loose pulley to receive motion by means of a strap from the moving power, whether water, steam, horse, or hand: the latter, of course, being least desirable, will only be used, when neither of the others is available. Upon this shaft is placed the fly wheel, the momentum of which, during one revolution at the rate of sixty per minute, is found, on trial, to be quite sufficient to overcome the resistance offered by the piece whilst subjected to the pressure of the dies. Upon the same shaft is the crank, which gives motion, through the pitman, to a lever and toggle-joint, the structure of which is exhibited in the left upper corner of the front view presented in figure 2.

The feeding of the blanks, or planchets, and their discharge after being struck, is performed by an excentric and set of levers, all combined in so simple a manner, as to be effectual, and not subject to derangement; as much so these parts as are visible in the two views, are faithfully exhibited; but it if impossible to describe them intelligibly without the aid of drawings of the separate parts; and, further, since the drawings were executed, changes have been made in the position and form of the excentric, by which the press is much improved. A general notice is all that is intended in the present communication.

The feeding tube is a vertical pipe to receive the blanks, in which they are placed by hand, and from which they are taken by the feeders; the latter are so arranged, that when a crooked, or otherwise faulty blank impedes the motion, (not an unfrequent occurrence in coining,) the whole is immediately released from action, and will not again operate until the impediment be removed.

A few familiar facts are added as evidences of the peculiar adaptation of the toggle-joint to coining, as proved by the operation of the press which is the subject of this notice.

1. The pressure acts with increasing force until the close of the operation, at which time its intensity is greatest, and it is always carried to the same extent.

2. No injury occurs from the absence of a blank from between the dies when the blow is given, an accident that results in the destruction, or great injury, to one, if not both of the dies, in presses of the ordinary construction.

3. An immense saving of labour From trial, we have ascertained that a man, with one hand applied by means of a common winch handle, can coin eighty pieces per minute (the experiment was tried upon cents, which have a diameter of 1 ^{1} inches). A boy, fourteen years of age, was able to coin sixty per minute, without any unusual exertion; and, lastly, it was impossible for the operator to tell, by the resistance offered to his exertions, whether the pieces were being coined or not.

It is by no means my wish to be considered the first who has applied the toggle-joint to the striking of coin. It is difficult to say to whom priority belongs; for presses on similar principles are in use

in more than one city in Germany, and their successful operation was witnessed at Carlesrhue, in the Grand Duchy of Baden. Particular advantage has also been derived from a careful examination of the coining presses of Monsieur Thonnellier, of Paris. It is just to observe, that none of these presses were perfectly satisfactory. I have, therefore, made my own distribution and proportion of parts, thrown off whatever was complex, and added such as were necessary to its perfection, particularly the arrangement for the disengagement of the feeders in case of the presence of defective pieces.

Our esteemed friend and fellow-citizen, Mr. M. W. Baldwin, several years since, commenced the construction of a press on similar principles. His talents and mechanical skill are amply sufficient for its completion; and it is to be regretted, therefore, that his numerous occupations have prevented the prosecution of the subject.

I take advantage of the present occasion, to make a few remarks on the application of steam power to coinage, as applied in the Royal Mint, on Tower-hill, London, which is one of the greatest curiosities in mechanics that I have ever seen, exhibiting consummate skill and great resources, on the part of the inventor, who, if I am not misinformed, was Mr. Boulton, of Soho Works. For a series of years this machinery was kept rigidly secret; some even of the officers of the Mint not having the favour of seeing it accorded to them, and it might yet have remained so, if it were not for the advancement of liberal principles, which bid fair to keep pace with the rapid increase of mechanical ingenuity and skill.

The direct application of high steam to the screw press, would have answered every purpose, but still better the substitution of the toggle-joint for the screw has rendered all this ingenious complexity unnecessary; but mechanicians may make their own inferences from the following sketch.

A low-pressure engine is employed to create a vacuum in a large *receiver*, (in this case a misnomer,) by means of an air pump, which serves as a reservoir of power, through the agency of which, the pressure of the atmosphere is exerted as occasion requires, both for the *blow* and *rebolt* of the screw press; the former produced by a cylinder and piston, furnished with valves, one of which opens to the reservoir, and the other to the external air; the latter, by a cylinder and piston, constantly acting, but with less power than the former. The valves are moved by levers which are struck at a proper time by a *plug frame* of similar construction to those employed in the ancient atmospheric engine. The power is communicated to the screw by tumbling shafts, connecting rods, and levers, the construction and operation of which could not be rendered intelligible without full drawings for reference. More words would, perhaps, render this brief notice as mysterious as the contrivance of which it treats; I will, therefore, close, by adding that eight of these systems, attached to eight screw presses, constitute the coining power of the British Mint.

FURTHER REMARKS ON THE REPORT OF THE COMMITTEE ON THE ARTS AND PRINCIPLES OF DESIGN.

Sir,—In a former communication (No. 696, p. 187), I ventured the remark, in reference to the Parliamentary Report on the Arts in connexion with Manufacture, that "the Committee seemed to have entirely lost their memory as to any fact creditable to the talents of their countrymen"—following up the observation with a few pretty striking proofs of the fact. On looking over the evidence on which the Report *ought*, at least, to have been founded, proofs of the same nature are to be found at every step "as plenty as blackberries"—so plentifully, indeed, that it becomes in some sort an amusement to detect the shifts to which the writer of the Report has been continually put, in contriving to omit all mention of British proficiency, and more especially of British superiority, and forcing forward every iota of testimony in favour of foreign pre-eminence, in order to justify the monstrous conclusion that the fine arts in England are in the lowest conceivable state of degradation, and particularly that the arts of design in connexion with manufacture, present, to use Milton's phrase, "in the lowest deep a lower deep." The leading members of this illustrious Committee were evidently "all agog" to convict the artisans of England of every possible species of bad taste; and several at least of the wit-

nesses seconded, with might and main, their patriotic endeavours. And with all this note of preparation, what does their bill of indictment amount to at last? Why, truly, its counts, after all, are so miserably few, and, few as they are, so many of them will not "hold water," as the lawyers have it, that the defendants may well think it hardly worth while to plead to them at the bar of public opinion. In fact, when the matter comes to be investigated, the *evidence* on which the prosecutors rely either flies so directly in their faces, or with a little sifting breaks down so completely, as to put them out of court at once and for ever, with "not a leg to stand upon!"

"The want of instruction experienced by our workmen in the arts," observe the Committee, "is strongly adverted to by many witnesses. This deficiency is said to be particularly manifest in that branch of our industry which is commonly called the fancy trade; more especially in the silk trade; and most of all, probably, in the ribbon manufacture. Mr. Martin (the celebrated painter) complains of the want of correct design in the china trade; Mr. Papworth (an eminent architect), of its absence in the interior decorative architecture of our houses, and in furniture. *Hence* the adoption of the designs of the era of Louis XV. (commonly dignified with the name of Louis XIV.), a style inferior in taste, and easy of execution. To a similar want of enlightened information in art, Mr. Cockerell attributes the prevailing fashion for what is called Elizabethan architecture; a style which (whatever may be the occasional excellencies of its execution) is undoubtedly of spurious origin."

And this is the sum and substance of the Committee's charges, a true copy of the whole bill of indictment! Well may we exclaim, "Is this the mighty ocean, is this *all?*" But it would be in vain to look for more, and, few and frivolous as these charges are, they lay a much greater weight on the shoulders of "our workmen" than they ought to bear. Passing by, for the present, that regarding the silk manufacture, let us look a little into the grounds of the rest.

"China-painting" may be soon disposed of by referring to the evidence. Mr. Martin *did* testify that the art was now in "a very low state;" but, at the same time, he gave a very good reason why it should be so—"when I first came to London, it was *just going out of fashion.*" This at once clears up the mystery; there was no want of "correct design" when correct design was well paid for—"it was their knowledge of drawing, &c. that made Mr. Moss and Mr. Marsh so superior to others; but *owing to the decline of china-painting*, they were compelled to leave it; and it has since entirely gone to the ground." So that it was no fault of "our workmen" that china-painting declined, but of their patrons; it "went out of fashion," and, being out, the inducement to attain excellence in its practice, or even for those who *had* attained it to continue in it, was gone. And "workmen" might as well be blamed for their want of skill in boring wooden water-pipes as in this insignificant branch of the fine arts—always supposing Mr. Martin's evidence to be undeniably correct. But Mr. Martin's evidence was by no means all that came before the Committee on the subject, although no other is alluded to in the Report. Why? Because it was favourable to the British artisan! The Committee were so anxious to express their sorrow at the comparisons which the witnesses "too frequently, *if not uniformly*, felt themselves compelled to draw" to the advantage of "our foreign rivals," that they could not find room for the slightest notice of the evidence of Mr. Batt, of the bronze and porcelain department at Howell and James's to the effect, that "in some branches of the porcelain manufacture the French are superior to us in design, in others *inferior*. In that description of porcelain which is of the same nature as the old Dresden china, ornamented with raised flowers, *we are vastly superior to them*, and a considerable quantity of such porcelain is, I believe, annually exported to Paris, and considered by the French *superior to their own.*" As a matter of course, also, while they devote a paragraph to the praise of the French, even for "their close study of the living flower," they are mute as to the evidence of Mr. Factory-Inspector Howell, who found "our workmen" at Worcester painting flowers on china from nature. To suppose, for a moment, that they should deign to notice the same gentleman's testimony as to the attendance of the Worcester china-painters on the lec-

tures of Mr. Constable, the R.A., would be ridiculous; and equally so to imagine that they should chronicle the unsavoury information (from the same quarter), that "there is an impression that the manufacture at Worcester is improving," and that he saw "a very beautiful service making for the Pacha of Egypt." Evidence of improvement is only admissible when it refers to our foreign rivals.

Now for Mr. Papworth, a gentleman of no great eminence in his profession at home, but who became a first-rater in Germany, when the King of Wirtemberg sent from the immediate neighbourhood of "the classic country of the arts" to find an architect capable of building him a palace, and could find none nearer than that abode of dulness, England! We need only turn to his evidence, to perceive at once that the Committee have grossly misrepresented its purport, and to find, that so far from attributing the prevalent defects in art to "our workmen," he lays the fault at the door of that Legislature of which the Committee formed an unworthy fraction. "I think," he observes, "the defects in art, as applied to manufactures, chiefly arise from the want of (not instruction, but) *protection*, because *there are a great number of clever artists in this country* who would occasionally (were their works protected) model a tablet, a frieze, or some other *work of art*, and would cast and sell the work in such numbers as would produce remuneration to the artist." Not a word have we here to bear out the charge of the Committee—but plenty to invalidate it, and that, too, be it remembered, from the mouth of one of the witnesses specially put forward to bolster up their cause. It is just the same with the next count:—"*Hence*," say the Committee (*i. e.* from the "want of instruction experienced by our workmen") "hence the adoption of the designs of the era of Louis XV." But what says the evidence of Mr. Papworth to which they refer? "The *absence of protection* has induced manufacturers to seek a style of ornament capable of being executed with facility by workmen unpossessed of theoretical knowledge, and without practical accuracy. This style has been fostered to a great extent, and erroneously termed that of Louis XIV." &c. &c. &c. Can any thing be more conclusive than this? Is any thing more wanting, after a comparison of the conclusions of the Committee, as in this instance, with the very evidence from which they profess to be drawn, to show in all its deformity the anti-national *animus* which must have actuated the getters-up of the concern? That charge must, indeed, be a rotten one, the evidence in whose favour is quite sufficient to prove it without foundation; and desperate, indeed, must be the condition of those who are reduced to the barefaced juggle of adducing, in proof of their "want of instruction" theory, the testimony of a gentleman who, like Mr. Papworth, distinctly traces the evil to so thoroughly different a cause as the "want of protection," and who, moreover, far from joining in the hue and cry against native talent in the arts, repeatedly bears witness not only to its existence, but its excellence!

The next burden "our workmen" have to bear is a heavy one. "*To a similar want of enlightened information in art*, Mr. Cockerell attributes the prevailing fashion for what is called Elizabethan architecture." Indeed! then the natural inference to draw would be, that Mr. Cockerell had made a very ridiculous assertion, and, even if he had made it, it argues a considerable capacity of swallow on the part of the Committee that they could entertain, for a moment, so preposterous an idea as that the prevalence of the Elizabethan, or any other style of architecture, is to be attributed to the "want of enlightened information upon art" among "our workmen!!! Whether Mr. Cockerell or the Committee originated the notion is of no consequence—it was most probably the latter—and the worthy architect perhaps little thought, when he was aiming a side-blow at the "want of enlightened information in art" displayed by the Houses of Lords and Commons in adopting the Elizabethan style for the new Hall of Legislature, that it would be turned against a body which usually has so little occasion to dabble in architecture as the working mechanics of the country. Whoever has to answer for the absurdity, "our workmen" require little to be said to defend them from *this* charge. The Elizabethan style is for the moment popular, and, of course, most of the architects of the day, and their patrons, think it ought to be so. Mr. Cockerell thinks other-

wise, and the Committee appear to adopt his conclusion.* But what has all this to do with the "want of information" among "our workmen?" The only persons in fault (if there be any) are clearly the patrons of architecture and its most eminent professors, with, at the head and front of all, Mr. Barry and the two Houses of Parliament. Let *them* look to it, and leave "our workmen" to answer for their own imputed offences against good taste as best they may, without being called upon to take upon them the sins of their superiors.

With regard to the "fancy-trade, and especially the silk manufacture," we are not referred by the Committee to the evidence of any particular witness, although this is undoubtedly their "great gun." It may be admitted, that our silk-weavers are not so forward in the race as many of our other manufacturers, but, at the same time, any Committee but such an one as this might have discovered plenty of indications in the facts which came before them, that the march of improvement has begun to be extremely rapid in this branch as well as others, and that "our workmen" in the silk line promise ere long to give their foreign rivals the go-by,—of which more anon. But why did this most candid of Committees omit to notice those branches of the fancy-trade in which British superiority is most decided,—why include all in one sweeping clause, without a particle of reservation, when scarcely a single witness was examined before them who did not make mention of some proof of British skill, aye, in those very "Arts of Design" most in connexion with manufacture? Why leave out the very name of iron-casting, in which we excel all our competitors so transcendently?—a line of art-manufacture far exceeding in extent and importance, as well as mechanico-artistical ingenuity, ten thousand such petty trades as China painting. Nay, why, if they can find room to particularise the exertions of an individual Frenchman to bring to perfection the Cashmere shawl, can they not do as much to celebrate the efforts of Mr. Smith, the very first witness they examined, to apply a higher order of fine art than usual to fenders and stove-fronts? Why could they not (always bearing in mind their anxiety to record instances of individual ingenuity *among the French*,) leave upon record that these productions were so beautiful as to call forth the admiration of Sir Francis Chantrey, or the more important fact that, among the artisans of Sheffield (who share with their neighbours the stigma of knowing nothing of art,) "there are several artists capable of producing such models as those," which excited the admiration of our great sculptor, and *which were produced* in proof of the skill of "our workmen" *before the Committee?* But it would be endless to enumerate all their omissions of this kind, although it may be worth while to note one of the most glaring. Among a Committee charged with such an investigation as theirs, it might certainly be expected that some persons would be found who had heard of the superior excellence of British pottery, both in its merely useful and in its artistical relations;—yet in no corner of the Report do we find a word about "Wedgwood ware," and this, notwithstanding Mr. Martin, whose testimony the Committee bring forth with so much parade when he condemns our productions in China-painting, had pronounced the articles of that ware to be "beautiful works of art," and notwithstanding another witness had duly informed the Committee that "Mr. Wedgwood improved the forms of pottery, and diffused them more than any other person." Had he and his work-people been Frenchmen, we should have heard enough of the obligations the world lay under to him and them for the wider diffusion of art. Wanting that requisite, they are treated with silent contempt; the most extraordinary instance on record of a manufacture rising up within the memory of man, and

* The reasons advanced (according to the Committee) by Messrs. Papworth and Cockerell for their respective condemnations of the styles of Louis XIV. and Elizabeth, are worthy of notice. The former, we are told, is not only "inferior in taste," but "easy of execution." Wherein consists the force of this latter objection? Would the Committee recommend the purchase for the National Gallery of the works of Cornelius Ketel, who painted, not with a pencil, but with his great toe? Surely, the usual method, that pursued by Raphael and Titian, must have been quite "easy" in comparison! Mr. Cockerell's objection to Elizabethan architecture is more formidable; it is, says he, of "spurious origin"—that is, we suppose, its parts have been invented at different periods. Mr. Cockerell is of that class of architects who would pull down St. Paul's. Why? Because it is not in the pure Grecian style; the Greeks were ignorant of the principle of the arch, and therefore (a very good reason) never introduced a dome!

in the heart of England, and diffusing classic grace of form in every habitation of the land (and not only our land but others), from the palace to the cottage, is passed by without a syllable of notice by a Committee sitting for the special purpose of tracing *the progress of the arts of design in connexion with manufactures in this country!* Why?—because all this did not take place *abroad*. Mr. Cockerell could be quoted in proof of the charge that "our workmen" are guilty of bringing into vogue the Elizabethan style of building, but nothing is heard of his whereabout when he is so injudicious as to observe, "I have found Wedgwood's works esteemed in all parts of Europe, and placed in the most precious collections of this description of works." So inconvenient a fact must have gone horribly against the grain.

Instances of point-blank contradiction, in the evidence of the witnesses, to the *very incorrect* statement of the Committee (or their reporter), as to the "too frequent, *if not uniform*" occurrence of a comparison disadvantageous to native talent, in the matter of design, in said evidence, are "too numerous to mention." A few may suffice. Mr. Smith is asked, with reference to his branch (iron ornaments), "Do you think the foreign models are superior, or inferior to the English?" And he replies (with a small degree, indeed, of "uniformity"), "In this branch of manufacture I think they are *inferior*." Mr. James, the eminent mercer, testifies to a very considerable improvement in the colours and patterns of the silk manufacture, and that "the importation of French silks has almost ceased in consequence of this improvement." Mr. Harrison observes particularly, that "there is *no want of talent* (for design) in the country, because there are a great many persons *engaged exclusively in the production of designs* for printed cottons, challis, and bandanas," —but who are not *yet* so conversant with the figuring of silk. The evidence of Mr. Batt, as to the superiority of British porcelain, at least in some departments, has been already adverted to: he concedes very freely to the French the superiority of design in metallic manufactures "with a few exceptions," which make sad havoc with the Committee's "uniformity," as they include no less than the whole of the manufactures in silver, gold, jewellery, and castings in iron, in which," Mr. Batt thinks, "we *excel* them in design." Mr. C. H. Smith, architectural sculptor, deposes that "the public demand for architectural ornaments increases and that the workmen have gradually improved,—that he has *no difficulty* in finding useful assistants, providing he can afford to give them a fair remuneration." Mr. Samuel Wiley, of the firm of Jennings and Batteridge, of Birmingham, adduces facts so important, and so strictly bearing on the question, that the omission of any allusion to them in the Report, taken in conjunction with the sweeping condemnation of English talent in design, and the succeeding paragraph as to the exceeding abilities of the French workmen in that particular, is rather extraordinary even for our Committee. He says, that the firm to which he belongs "have made great improvements in the japan trade of late years. Being men of taste, and stimulating their apprentices and teaching them the art of drawing, *our men* have inserted *works of art* in the Birmingham exhibition* and other places. * * * * * Every workman designs his own pattern. A good designer is well encouraged—he is a most valuable man. *The French prefer our articles*, because they are much better in material, workmanship, and *design*, in character, beauty, and every thing. They do not seem to raise the japan-trade to an art; they appear merely to daub it over, and call it japan; there is neither design nor beauty of execution in French work. * * * Our workmen generally come at twelve or fourteen years of age. We teach them first of all *drawing and designing*, and then manufacturing." A pretty specimen this, of that uniform testimony borne by the witnesses to the fact of English inferiority in the arts of design which the Committee so fervently lament! After this, to cite more instances would be an useless task:—any thing more complete, more thoroughly condemnatory, more satisfying as to the Committee's *animus* could hardly be expected.

Another proof of the foreign bias of the Committee might be drawn, if it

* Mr. Wiley might have mentioned that the late eminent R. A., Mr. Bird, whose pictures of Clevy's Chace, and Illustrations of the Bible, elicited such high admiration, was originally a painter of tea-trays at Birmingham. It *was* mentioned to the Committee that Flaxman, the sculptor, and Mr. Wyon, of the Mint, were brought up at Soho.

were required, from the simple fact, that the only witnesses who were subjected to what may be termed a cross-examination, were precisely those who had the temerity to express an opinion in favour of our native workmen,—amongst whom the editor of the *Mechanics' Magazine* came in for the greatest share, although his cross-examiners certainly "took nothing by their motion." It is impossible to read without amusement the answers returned by this witness to some of the *puzzling* questions propounded by the wiseacres of the Committee,—to observe without a smile the manner in which he makes his replies *tell* to the confusion of his pragmatical questioners. For instance, when some M.P. is determined to make it appear that the public call for none but the most classical of designs, while the workmen persist in thrusting inferior designs down their throats, sorely against their will, how completely is he put down by the quiet observation, "there is a pattern which was a long time in very general use for table-service, called 'the willow pattern'—*there is nothing very classical in that!*" Again, how pleasantly are the Committee rebuked for their disposition, to run down our home-bred taste to the exaltation of every nation "on the Continent," by the remark that "very much of the bad taste of this country has been owing to the circulation of wretched prints all over the country, and still more wretched stucco-images," and that "this inundation of execrable taste has not proceeded from native artists, *but from Italians!*" Oh! for a Cruikshank to have sketched the elongated physiognomy of the Honourable Member at this truly home-blow! Shocking, indeed, it must have been to the feelings of the whole Committee to be reminded thus unceremoniously that the public taste is now too improved to put up with the trash these foreigners were guilty of perpetrating, but required something far superior,—in the shape of casts from the works of Chantrey, an English professor of the "highest branches of poetical design," and of Thom, one of the very class of mechanics whose inferiority in the arts of design is so deeply to be deplored!

A good sifting cross-examination might have been employed to better effect in a far different quarter. Mr. Donaldson, the architect, gave a first-rate opening for any member of the Committee—had there been any,—with a British feeling, to "show up" the true value of his evidence. This gentleman, by way of illustrating his position as to the cheapness of art in France, instanced his own work on doorways, the plates to which would have cost him four guineas each in England, whereas he "sent his drawings to Paris, and had estimates from four French engravers,—put the work into the hands of the best of these,—*a man who is second to none in Europe in his art*,—paid the expense of the carriage of the plates to England, the duty of 30 per cent., and various incidental expenses, and the whole cost did not exceed two guineas! Now it appears that Mr. Donaldson had just before introduced to the Committee the "*Vorbilder fur Fabrikanter und Handwerker*," of which we hear so much in their Report. What, then, if our imaginary cross-examiner, after a due time spent in admiration of the most elaborate of all the plates, had begged of Mr. Donaldson to give him the name of the engraver. Would he not have felt a little embarrassed as he answered "WILSON LOWRY?" Suppose the same process repeated with a second, a third, a fourth,—the masterpieces of the whole work,—would Mr. Donaldson have been able to suppress a blush as he stammered forth the names of TURRELL, ROFFE, and MOSES, all well known as first-rate *English* engravers? Terribly would he have been perplexed as the annoying questions poured in upon him. How was it that Professor Beuth entrusted *none* of his elaborate embellishments to the Frenchman, "who is second to none in Europe in his art?" How came he to pass him by, with all his cheapness, and send his work to the high-priced English engravers, paying to boot "the expense of the carriage of the plates to Germany, the duty, and the various incidental expenses connected with their being executed in London and transmitted to Germany?" Simply, of course, because Mr. Donaldson's Parisian engraver could not come nigh our countrymen in the practice of the highest branches of the art. Mr. Donaldson's doorway plates may have been done cheaply, but they can hardly have been done well,—*as* well as they would have been here. To suppose otherwise, is to suppose Professor Beuth a natural-born

fool, and the Prussian government a sad waster of its cash. Nor can the Germans in general be much wiser than the Professor, for with them a book "*mit Englischen stablistichen*" is considered a very superior affair. The Russians, too, must be a stupid set, when they send to "dear old England" if they want a first-rate embellishment, instead of putting in requisition the talents of the half-price Frenchman, "who is second to none in Europe in his art." But what are we to say to the French themselves, who, in spite of their possessing this cheap first-rate, —"second to none in Europe in his art," not only invite English second-rate engravers to Paris (who there suddenly find themselves promoted to the front rank of the profession), but actually encounter the higher charges of *our* artists, and all the expensive *etcetera*, whenever they wish to bring out a book or a print *in the very first style of art*. It is so notorious that even Mr. Donaldson must have allowed it, had it been put home to him, that any Parisian engraving of unusual excellence will be found, on examination, to have an English name in the corner.

This letter has already extended to so great a length, that, for fear of trespassing too long on your and your readers' patience, I hasten to conclude by subscribing myself,

Sir, yours most respectfully,

H.

London, Jan. 17, 1837.

IMPROVED TIMBER-RAILWAY BASE, AND SADDLE-RAIL.

Sir,—I beg to offer my ideas of Mr. Vignoles' project for longitudinal timbers for the upper works of railways. It appears, in my view, that the scantling is too slight, and that the material composing the rail is not disposed to produce the greatest strength.

Suppose the Memel timber to be sawn diagonally, four pieces will be the result, as before; but instead of 9 inches bearing, they will have 13 inches, and instead of a depth of 4½ inches, they will be 6½ inches; and in the shape, very nearly approaching to that which has been demonstrated to be the strongest, with a minimum of materials. The following *hasty* sketch will explain.

Fig. 1.

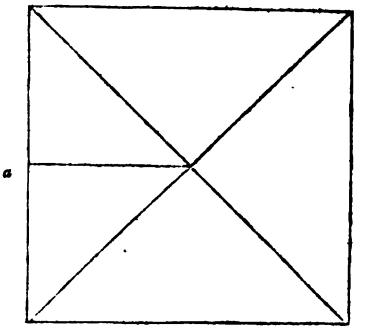


Fig. 2.

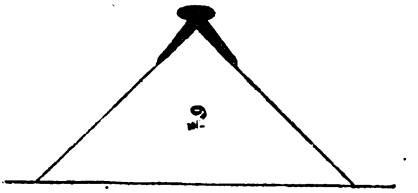


Fig. 3.

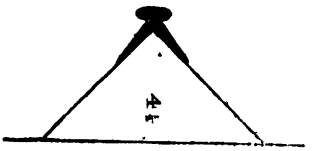


Fig 1 shows the Memel timber, with the saw-kerfs for cutting four. Fig. 2, the timber in position, surmounted with the rail cast saddle-ways, presumed to contain 48lbs. per yard.

In p. 259, Mr. Vignoles states that if an equal economy in sawing up of the timber can be otherwise obtained, wrought-iron rods may be used to keep the track in gauge; of course, they will be applicable here.

Figure 3 shows the practicability of getting eight timbers out of the baulk fig. 1, by cutting again from *a* to the centre. I do not venture to say this will be strong

enough, but as the bearing and the depth is the same as proposed by Mr. Vignoles, I have shown it on the score of economy, and think it will be equally applicable as his on solid, or unmade ground.

I am, Sir, yours truly,
W. THOROLD. C. E.

Norwich, Jan. 14, 1837.

ACTION OF THE ATMOSPHERE IN BOILING WATER.

Sir,—I cannot refrain from troubling you with a few remarks on that collection of errors which appears in a recent number, under the title of "On the Action of the Atmosphere," and which bears the signature of "W." As the *whole* article is composed of details of experiments, explained on the most miraculous principles, for the purpose of supporting the theory which is advanced in the first sentence, we cannot do better than examine the experiments, and show the absurdity of the explanations, in the order in which "W." has arranged them.

In the first place, "W." asks, Is not boiling "caused by a current of air, which enters *through* the bottom of the vessel, rises up through the water, and thereby causes the bubbling?" &c. How "W." could imagine that air would penetrate "through" a piece of metal was to me a matter of surprise, until I found it accounted for most readily in another part of his remarks. "The heat of the fire," he observes, "rarefies the air, expands the metal of the vessel, and by *these means* the air appears to be enabled to penetrate the metal!" But "W." will find that "these means" are not adequate to produce the effect which he ascribes to them; for if he will trouble himself to procure a metallic vessel, and after heating it much hotter than the temperature of boiling water (and consequently causing the metal to expand much more), expose it by means of a condensing syringe to a very great pressure, and not merely to a current of hot air, he will find that after exposing it to these additional "means," not a particle of air will penetrate it. Thus we see that boiling cannot be caused by the bubbling up of air, which has "*penetrated*" the metal; and if "W." still maintains that it is caused by "currents of air," he must show, in a more satisfactory manner, how the air arrives at the bottom of the vessel.

He next asks, "Does not the light coloured matter, which is called steam, consist of particles of water thrown up and carried off from the surface by the air, as it rushes through the boiling water?" Steam is not "light coloured matter," but is perfectly invisible, and although it consists of particles of water, the particles are not torn asunder by the "rushing" of air through the water, as "W." supposes them to be, but stand at the great distance from each other, in which they are found in steam, by virtue of heat, and without any connexion whatever with the air.

"W." next directs attention to the phenomena which present themselves, in the passing of cold water to the boiling state; he imagines that the small bubbles which appear on the sides of a vessel of water, when becoming warm, are the first appearances of boiling. Truly, these small bubbles are portions of air; but they are not produced on the sides of a vessel from "currents of air" which "penetrate it," but have first been absorbed from the atmosphere, by the water being exposed to it; and if "W." will take a portion of water, and expose it under the exhausted receiver of an air-pump, he will observe that these bubbles of air will rise from it without the assistance of heat, and that the water thus freed from air, will no longer exhibit these small bubbles on his applying heat to it.

Another argument which "W." uses to support his theory is, that "if a tin vessel containing water be partly immersed in a vessel of boiling water, the water in the tin vessel may be raised to a boiling heat, but will not boil," because, as he supposes, the air is excluded by the boiling water which surrounds the tin vessel. Here he first tells us, that the boiling of the water in the large vessel is occasioned by the "currents of air" which "penetrate the bottom" of it, and rise to the top; but he says that the water of the small vessel cannot boil, because the air has no access to it. Pray, what becomes of the "currents of air" which rise from the bottom of the large vessel in which it is immersed? In rising they must inevitably

strike against the bottom of this tin vessel: and as metal, at the temperature of boiling water, is readily penetrated by air, according to "W.", why do not the currents of air pass straight on through the tin vessel, and cause boiling in both portions of water? Perhaps "W." will say, that the currents of air are not presented to the bottom of the tin vessel in a favourable manner, and that, from the density of the water, they rise through it so quickly, as to escape without having had an opportunity of passing through the tin vessel; but "W." may make the tin vessel with a concave bottom, and then what he calls the "currents of air" will collect under the tin vessel, and will be pressed against its bottom by several inches of water: and if currents of hot air pressed against the sides of a vessel, merely by the superior density of the air surrounding them, will penetrate the vessel, surely air of the same temperature, pressed against a vessel by several inches of water, ought to pass through it much more readily; and thus, according to "W.'s" own theory, the water in the tin vessel ought to boil *more rapidly* than that in the vessel in which it is immersed. But "W." says it is not so, and, consequently, this one fact which he adduces to support amply his theory, is sufficient for its complete destruction.

We are next informed, that if we insert a tumbler filled with water in the vessel in which the water is boiling, that the bubbles of air will ascend into the tumbler, and by displacing the water, will fill it with steam, or what "W." calls "currents of air." Now, the science of pneumatics teaches us that air is possessed of the common properties of matter, and among others of indestructability and of impenetrability, or the property of not allowing another species of matter to occupy the same portion of space as that in which it exists, until it be removed. From this we may infer, without any great stretch of our reasoning powers, that the air in the tumbler, if we did not cause it to be removed, would remain there an indefinite length of time. But "W.'s" air is not common air; for let the water, over which it is confined, cool a little below the boiling point, and this air which was collected in the tumbler will disappear,—not one jot of it will be left in the glass. Now, if it really be air which was collected in the tumbler, let "W." show where it has gone to, or how escaped.

I think from these remarks, "W." will perceive that boiling is not caused by currents of air penetrating the bottom of the vessel; and if, for argument's sake, we allow that it were, he will see this inadequate for the explanation of the phenomena.

I cannot conceive that "W." made his remarks on boiling in ignorance of the real nature of the process, for he certainly must have observed facts that were in direct opposition to his theory. Did he never see water boiled under the exhausted receiver of an air-pump, and that much more rapidly, and at a lower temperature, than when exposed to the atmosphere? Or, is he not aware that ether will boil at an ordinary temperature, when placed in a vacuum; and that every substance is evaporated more readily when protected from the atmosphere, than when exposed to it? If he has seen these phenomena, he must immediately perceive that "currents of air," rather than being the sole cause of this phenomena, are positively prejudicial to it; and if he has neither seen nor read of these experiments, I think it would have been prudent of him, before publishing such inconsistencies, to have consulted some treatise either on heat or on air; for after so doing, he certainly would have abandoned such "vain reasoning all, and false philosophy."

The bubbling, &c., which we call "boiling," is occasioned by the rising of steam from the bottom of the vessel, in which the boiling water is contained. "W." will find that on first applying heat to water a motion will take place in it; the water at the bottom of the vessel becomes expanded by the heat, and as it is then of less specific gravity than that at the top of the vessel, it immediately rises and displaces the upper portion, which descends to the bottom of the vessel, then becomes heated, and in its turn rises: and thus a continual circulation of the water takes place during the time in which it is becoming hot, until it arrives at about 212 degrees Fah., when the phenomenon of boiling commences. "W." is, perhaps, aware that all substances may, by the application of heat, be made to resign the solid

form, and to appear in the state of vapour; and that the temperature at which a substance passes into this state, is, under ordinary circumstances, fixed and unalterable. Thus he will find that he cannot cause the water, with which he experimented (unless it be impure or subject to pressure), to become of higher temperature than that above mentioned; as, on applying heat to it after it has arrived at that temperature, it will only cause it to boil, the heat being expanded in the form of steam, while the water will remain of precisely the same temperature. I presume from this, "W." will perceive the process of ebullition to be the rapid formation and escape of steam, instead of "currents of air." I will now attempt to explain to "W." the reason why a vessel of water, on being immersed in boiling water, does not also pass into the boiling state. Although boiling water is of the temperature 212 deg. Fah., yet it requires a greater heat than that to make it boil. The reason of this is, heat is an essential ingredient in the *composition* of steam. If *we take a pint of water of the temperature of* 212 *deg. Fah., (the boiling point), we shall find that it requires a very great quantity of heat to convert that water into steam of the same temperature.* Hence, the heat we apply is absorbed by the water, and becomes one of the component parts of the steam, where it lies dormant so long as the vapour is kept from cooling; but immediately it becomes lower than 212 degrees F., the water of the steam is condensed, and the heat which had entered into the composition of it instantly becomes apparent; and "W." will find that the heat, which the steam from the pint of water gives out in condensing, is sufficient to raise very much more than the quantity of water from which it was produced to the boiling point. "W." will now perceive why it requires the application of a greater degree of heat than that of boiling water, to make water boil; and he will see the reason why one vessel of water does not boil on being plunged into another vessel that contains boiling water. He will perceive that it is not, as he supposed, because the air could not have access to it; for if he had plunged the tin vessel into boiling oil or quicksilver, either of which would have excluded the air as effectually as water, he would then have found that the water in the tin vessel would have boiled, because the temperature of either of these bodies, when raised to the state of ebullition, is greater than that of water when brought to the same state. Trusting "W." is convinced of the monstrous absurdity of his theory, and hoping that you will admit this into your columns, to prevent the diffusion of such an erroneous theory,

I remain, Sir, yours, &c.,

G. S.

Aston Road, Birmingham,
Jan. 7, 1837.

ENGRAVING MEDALS BY MACHINERY.

A petition was lately presented to the House of Commons from Mr. Tilt, the bookseller, of Fleet-street, which sets forth, "That a machine has been invented, and is now brought to perfection, by which the likeness of any object, represented in relief, can be accurately transferred to a plane surface on any proposed scale, so as to affect the eye in precisely the same manner as the original—That by the use of this invention the object which your petitioner proposes [the publication of engravings of all the medals in the British Museum] could be effected with the most minute precision, at a cheaper rate, and in a manner far more perfect than if the ordinary methods only were employed—That eight medals on an averaverage, with their reverses, could be included in one plate, were the size of imperial quarto adopted for the publication, which would thus require 400 plates for its completion—[there being 3200 in the British Museum collection]—the whole series could be comprised in five volumes, and produced without difficulty in the space of five years—That your petitioner submits that the publication in question, which relates to a class of national antiquities, now open but to a few persons, and which throws so much light upon the history of the country, must be regarded as an important national work, and that many countries of Europe, as in France, Italy, and Denmark, the same has been already produced at the expense of their respective governments." The House referred this petition to the committee on the British Museum, who devoted several sittings to the exclusive consideration of the subject matter of it, but at last contented themselves with simply reporting to the House the the "Evidence" of which the substance follows.

Mr. Charles Tilt

Thinks that the publication of the historical medals in the British Museum collection, engraved by M. Collas' machine, would be of great interest, and would have a consider-

able sale, both at home and abroad, but not sufficient to defray the expenses of publication, and leave a profit to the publisher. Would undertake the publication, if Government would grant assistance to the amount of about 20 per cent. It would be best to publish such a work in parts;—80 parts, containing five plates, with eight medals, and their reverses on each, would take in 3200 the number of medals in the Museum collection suitable for such a publication, making five volumes; they could be published at 5s. 6d. a part, if Government paid 20 per cent. of the cost. If he undertook the work, he would make a contract with the parties in Paris for the plates,—the engraving being executed there, and the printing in London. Is not aware of any individual in England who has a machine that would engrave the plates with sufficient accuracy and rapidity. Mr. Bate has attempted it, but witness has never seen any engraving produced by his machine that was altogether satisfactory. Understands that it requires the superintendence of a species of artist, and that consequently the machine must work very slowly; in M. Collas' machine, the process is mechanical.

Sir Francis Chantrey.

From the specimens of M. Collas' engravings, thinks they are the most satisfactory representations of medals he has seen—more satisfactory than any he has ever seen produced by the ordinary mode by engravings copied from drawings—much more faithful.

Edward Hawkins, Esq., Keeper of the Antiquities in the British Museum.

Has compared engravings taken by the machine of M. Collas with the medals themselves, and thinks them the most satisfactory copies of medals he has ever seen. One of the excellencies of the mechanical process is, that it does not give any thing but what is upon the medal; it may not give a full and entire representation of all that is there, but the defect is one of deficiency, not of inaccuracy, or rather, not a misrepresentation. The distortion or inaccuracy of the engraving, where the medal is in high relief, in the state to which the machinery has now been brought, do not now strike the eye of an observer as distortions. Is of opinion that the accuracy of casts for the purposes of the machine can be insured; engravings from inferior or inaccurate casts, afterwards compared with the medal itself, would be to the disadvantage of the engraving; for instance, the medal of Henry the Second, with a Greek inscription (among the specimens before the Committee), is copied from an imperfect cast —the inscription is entirely altered, ΘΕΟΣ ΑΠΟ is converted into ΘΛΟΣ ΑΡΟ;—the machine has faithfully represented the imperfection of the cast. Any mechanic, with ordinary care and attention, can work M. Collas' machine with success—saw several persons at work in the establishment in which M. Nolte is concerned, and there were several females at work, and it seemed to require nothing but a steady hand—no artistical skill at all. Tried the publication of engravings in outline of the medals in the British Museum collection as a private speculation, but it did not succeed; a publisher also, after having gone to the expense of preparing prospectuses for such a work, abandoned the project on account of the great expense, and the little probability of getting an adequate return. The work would be exceedingly incomplete if confined to the medals in the Museum; there are many in private collections, some even unique, which it would be necessary to comprise in any such publication. Machines for engraving medals have been constructed in America and England, as well as in France; but it is in France where it has been brought nearest to perfection. The specimens before the Committee are all from French machines. Thinks the mechanical part has arrived at its full measure and excellence; but it is difficult to set bounds to any mechanical improvement. The discovery is very good for representing large specimens; but the higher the relief, the more will be the apparent distortion. If a cast of the head of Louis Philippe, about nine inches diameter, engraved by this process, the effect is exceeding good—no distortion is seen. In high relief it is not a distortion of the line to produce an effect, but actually distortion, yet nothing offensive to the eye. Those medals and parts of medals to which the machine is least suited should be retouched by the hand. The machine engraves inscriptions very faithfully, but not so distinctly as is desirable—should there use engraving to assist. For a publication of medals this would be the best, and perhaps the only practicable mode in which it could be executed—the best, as giving the most faithful representation of the medal—and as to expense, the only practicable mode. Supposing a medal were to be engraved by the finest artist, and one by the machine, the former would be a more pleasing work to the eye—but not to be trusted to as an historical work so much as the latter; it would not be so faithful a representation of the medal. Supposing the publication to be undertaken at the expense of the public, and therefore to become a national work, and without any regard to expense—taking the three modes of executing the engravings—in outline, by the finest artists, and by the machine—into con-

sideration, the work by the artist would perhaps be the most pleasing and the most honourable to the country; but as an archæological work, in which is required a faithful representation, witness would adopt machinery, and assist it when necessary by the graving-tool.

Sir Francis Chantrey further examined.

In proportion as the relief of the medal operated upon by the machine increases, the deviations increase, which so far affect the precise accuracy as not to allow measurements from the centre to agree—but not so as to make the representation unsatisfactory, being aware of the uniform deviation in the machine; by the common method of engraving you are subject to differences in various parts—here the differences are limited, and you can understand them, but you cannot rely upon the differences which are incident to the eye and hand of man. The machine is totally inapplicable to engraving in full relief, because in the full figure the relief is only given by shadows thrown from the projections; now as this machine cannot feel shadow, it can only represent substance by the form of its line, and therefore this machine, like all other machines, has its limits, and is applicable to medals more particularly than any thing else, and the flatter the medal the less will be the distortion, as it is called; it is not distortion, however, but a deviation of very little importance, more particularly when it is in the same proportion to the relief, and when you know that it is of no consequence whatever.

Letter from Sir Francis Chantrey to the Chairman of the Committee.

Belgrave-place, June 15, 1836.

Sir,—Since I gave my evidence yesterday concerning engravings made from medals by a machine, I have conversed with Mr. Wyon, the Engraver to the Royal Mint, who informed me that there are several machines in this country which produce copies of medals in true proportions in all their parts.

I beg leave to enclose an impression which he gave to me; it is from a plate engraved by Mr. Bate's machine. It appears to me that in this impression the "distortion," as it has been called, is entirely obviated. I understand that a similar machine is in possession of a person of the name of Lacy.

In the enclosed print the effect of relief appears inferior to most of the engravings by the French machine, but that, I presume, may depend, in some degree, on the direction of the lines; in this instance they run obliquely, and had I been aware of this improvement in the machine, I should have stated it yesterday; perhaps you will think it important enough to add to my evidence.

Yours, &c. F. CHANTREY.

Mr. Vincent Nolte

Is the founder of the company in Paris for engraving medals, &c. by M. Collas' machine. "The origin of this thing is, that M. Collas, a mechanic, who, when the revolution took place in 1830, found himself without any particular employment, remembered to have seen the outline of a machine in the *Manuel des Tourneurs*, and he contrived to make one upon different principles to produce the same effect. At the end of 1831 some specimens thus produced were so satisfactory to myself, and a number of artists with whom I was connected, that we thought it would be a good thing to make some publication, with engravings of that description; however, we did not embark in it without having tested the excellence of the proceeding, by consulting the very best authorities among men of science as to the faithfulness of the engravings, and among artists as to the effect; and those persons were, Mr. Horace Vernet, Mr. Le Normant, Mr. Tiolier, the engraver of the Royal Mint in Paris, and Mr. Barre; Henriquel Dupont, our first engraver, and Mr. Paul de la Roche, member of the Institute, were also consulted upon the subject. Their unanimous report was of that description, that we thought we could venture upon any thing: we commenced by saying 'I will advance so much money; you will supply some other sum,' and in that manner this company was organized and formed for the purpose of executing engravings of medals, coins, basso relievos, cameos, intaglios, and things of various kinds, of which I have a variety of specimens. When the first specimens came out, we all calculated that on account of the pleasing nature of the work, the number of subscribers would be very great; but we found that we had no more than 180 to 200 subscribers, which was perfectly insufficient to defray the expenses of the establishment; we then thought of calling in aid from the Government of France, and having felt the pulse of the Minister of the Interior, he gave it his decided approbation, and we then proceeded in the usual way by presenting a petition to Government, supported by such evidence as we thought useful to obtain the desired result. The Government upon that determined to give it its protection, by the King and the Royal Family subscribing for a certain number of copies: and the libraries and other public institutions of that description did the same. The whole amount of copies thus taken by Government was about 350, and in value equivalent to the receipt of 17,000*l*. After the Government had subscribed, the encouragement became then very general; the public fell in with the views of the Government, and the celebrity of the undertaking

has been spread a great deal throughout Europe. We have received from various parts of Europe where there are collections of medals, orders for the execution of plates, and that has led me to England, under the impression that encouragement of the same kind would be given in this country if some public work was undertaken. I was not aware at that time that the medallic history of England was a blank in literature, in fact, that none existed; and it is only since I have been in England that I have discovered that it would be desirable." Witness has consulted the principal publishers' houses in London, but all declined undertaking the work. Mr. Tilt has agreed to publish, provided the aid of Government can be obtained;—his calculations are founded upon the sale of 2000 copies. Precise casts of the medals would be taken and sent to Paris, where they could be executed better than in London, from the engravings being superintended by artists appointed for that purpose. With respect to the comparative cost of engraving by machinery, and by the ordinary mode, the following instance may be mentioned. When the question was whether the machine could execute difficult medals, the celebrated Soane medal was sent over to Paris and engraved. "It appears that Sir John Soane had put the medal into the hands of a gentleman of the name of Bate, who has invented or perfected a machine somewhat similar as to the effect of it. With the result of this engraving he does not appear to have been exactly satisfied, for he employed Mr. Corbould, the painter, to make an outline of the Soane medal, which was afterwards engraved by Mr. Freebairn, and Mr. Freebairn told me that the engraving was paid for to him—forty-five guineas for the head and the other side of the medal. Now we should consider ourselves well paid by eight guineas." The time taken to execute engravings of two medals shown to witness [but not described in the Report of the Evidence], was from a day to a day and a half; but they made a great many unsuccessful attempts; sometimes two days to do it with great nicety. The adjustment of the machine is sufficiently accurate to apply it to taking patterns for the use of manufacturers from off damask silk—has a plate as a specimen of the kind. The plates will bear from 9000 to 10,000 impressions being taken from them without showing it in the least.

William Wyon, Esq., Chief Engraver to the Mint.

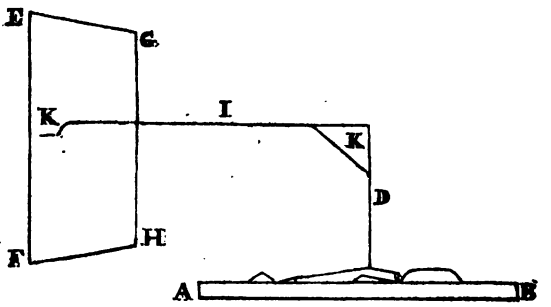
Is acquainted with several methods of engraving medals by machinery. "The first attempt of the kind was described in the *Manuel de Tourneurs*, published in France many years ago. The invention, I believe, remained in abeyance until about 1828, when the Americans published a series of portraits from medals of illustrious men; this induced the late Mr. Bawtree, engraver to the Bank of England, in conjunction with Mr. Bate, to construct a machine; and one of the earliest specimens of engraving by their machine was a medal executed by me for St. Thomas's Hospital. It will be seen on comparing the medal with the engraving that the head of Cheselden on the obverse is manifestly distorted; the same fault is visible in the figure upon the reverse, although from parts being smaller, the distortion is not quite so obvious; the effect of the whole is, that of having been taken from a worn-out medal. This latter imperfection may, in some degree, be caused by bad etching." Witness suppressed this engraving,—this was done in 1830. Another medal by him was engraved by a machine of Mr. Lacy, in 1832, which is a little improvement upon the former works, having the superintendence of an eminent engraver, Mr. Heath. About 1831 or the commencement of 1832, Mr. Bate finding the distortion that existed in all works of that kind, made another machine, for which he obtained a patent. Believes that the whole of the errors are now rectified, and that we have a perfectly accurate representation. Has given another impression of the Cheselden medal of Mr. Bate to engrave with his improved machine. As a medallist of great experience, is perfectly satisfied with the results of the improved machine of Mr. Bate, as to the accuracy of the representation. In many respects the machine gives a more faithful and accurate representation, as to the metallic appearance of the medal, than any other mode with which he is acquainted. At the same time, there are many subjects incapable of being properly represented. For example, architectural buildings, battles by sea or land, any thing dependent on minute execution, cannot possibly be executed with the same perfection as by the skill of an artist. In inscriptions it is of the utmost importance to the archæologist and numismatist, that even the shape of letters, &c., should be preserved, in order to fix the epoch. Submits to the Committee an engraving by hand of the Soane medal, executed by Freebairn, from a drawing by Corbould; the medal is by witness. If the capitals of the columns in the engraving be examined, you will find very superior accuracy in the minuteness of the detail. The engraving of the same medal by the French machine is inaccurate in several of its parts, which may be observed by measuring it with the compasses; from the lobe of the ear to the point of the nose most projecting in the outline, is nearly

an eighth of an inch greater in the medal than in the engraving. Is not sufficiently acquainted with the French machine to explain accurately the cause of this distortion, but believes it arises thus:—the tracing point that moves over the medal itself moves in a straight line across it, while the cutting point, which is transferred to the copper, takes a curved direction, consequently there is an inequality between the two. In an engraving of the same medal also, executed by Mr. Bate's improved machine, not the slightest disproportion exists; it is quite accurate. Mr. Bate has the merit of having modified his machine, so as to obviate the distortion which characterised the engravings of the original machines. In comparing the large medal of Napoleon and Maria Louise, which was engraved in France, with one executed in England, the English medal is perfectly circular, but in the French there is a considerable disproportion; the hollow part of the rim of the right-hand side of the medal is considerably larger than it ought to be, somewhat narrower on the left-hand side. In the English it is perfectly concentric. Is not sure that, in consequence of increased accuracy in point of outline, there is any sacrifice of the effect of relief. In this case, unquestionably, the French have the superiority in the brilliancy of impression. In France there is a kind of Committee of Taste, to examine every work before it is put into the hands of the machine engraver; this Committee directs the way to throw the lights and shadows, and thus, by having the advantage of art conjointly with that of mechanism, a more brilliant and better effect is produced. The machine, in its present state, is capable of doing every thing that is required, if properly directed by artists. Again, comparing the French engraving of the same medal with the medallion itself, by measuring the distance from the corner of the eye to the greatest projection of the frontal sinus, in the head of Napoleon, the space occupied will be found more than one-third smaller than in the original. On taking the same measurement from the medal copied by Mr. Bate's improved machine. it is quite accurate. Thinks that it would be a great stimulus to the art of medalling, if the collection of medals in the British Museum were engraved—the greatest possible benefit to the numismatic science and to the country at large.

William Brockedon, Esq., F.R.S., &c.

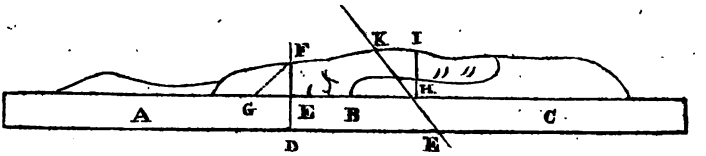
Has a knowledge of the different processes of engraving medals, cameos, and embossed surfaces by machinery—by the old machine and Bate's improved machine. "I have now before me a medal which has been cut in sections, in order to explain the difference between the old and the new processes; it is a French medal of Napoleon and Maria Louise. The earliest process with which I became acquainted was that we now term the old; that was four or five years since. Though I had not seen specimens, I know that a similar process had been employed at a much earlier period; for there is a French work called *Manuel de Tourneur*, of which a second edition appeared in 1816,—a process by which, in a rough way, embossed surfaces can be drawn or laid down upon plane surfaces with the effect of relief. Mr. Babbage has referred to this work. I will now endeavour to explain the old machine:—Having laid down the medal (A B, fig. 1) to be engraved, the vertical tracing-point, D, of the instrument, is made to pass over it at right angles, with the plane of the medal; and, consequently, as it passes it must be raised and lowered as it follows the variations of surface in the medal. In order, at the same time, to trace such varying lines upon a plane surface, imagine a plate of steel or copper, E F G H, upon which the image is to be traced for etching, placed at right angles with the plane of the medal: you will perceive that the tracing point D is lifted, and passes through a vertical plane across the medal. It lifts also the etching point I, attached at the right angles to the tracing point D, and marks upon the plate a curved

Fig. 1.



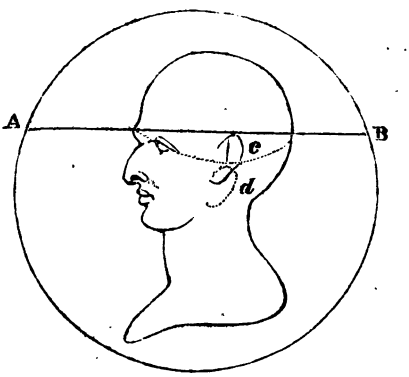
line K, which agrees perfectly with the curved line described by D across the medal in lifting. A straight line across the field of the medal, would be represented by a straight line also on the plate; but wherever there is relief or embossment, this lifts the point which touches the medal, and the etching point marks its course. Now, the fault to which that process is liable, will be found in many of the examples which have been placed before the Committee to-day, not only in those executed by the old English machine, as in the case of Chesekden, but in other examples from the French, which have been measured, and shown to be distorted and erroneous; and the way in which that distortion is produced, I think I shall be able to explain. Here are three pieces (A B C, fig. 2), which united make a complete cast or impression of the large Napoleon and

Fig. 2.



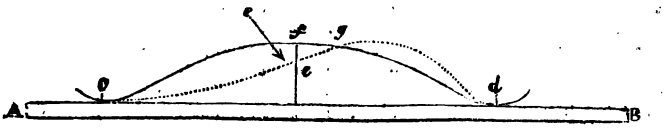
Marie Louise medal; the pieces exhibit two sections across the medal, one is at right angles with the field at D, the other at an angle of 45° with it at E. I will at present speak of the right-angled section only. The tracer, as in D, fig. 1, in passing over in the direction of the section D, fig. 2, would trace in rising over the curved surface, from E to F, a similar curved line on the plate, but which curved line would not be represented on the plate as at E, but at G, as far from it as each point touched by the tracer is above the base, and the error in the representation amounts to the whole of this difference. This error exists in all the old machines that I have seen, and must exist in all of which the productions exhibit this defect. These defective machines present, if the lines be horizontal, the appearance of the top of the head leaning towards the observer; thus if the line A B be traced across the medal, fig. 3, touching the top of

Fig. 3.



the ear, the dotted line representing the curve of elevation of the head in relief, will represent the true position of the ear in the medal *c* in the false position of the dotted ear *d* in the engraving. The outline of the engraving when traced by either the old or the new machine, is correct; the distortion is in representing the relieved or embossed objects within it. A familiar illustration of this may be given. Fig. 4, A B, is a table,

Fig. 4.



upon which is a piece of paper fixed at the opposite edges *c* and *d*, but so pressed together that the paper rises in the curve; let the point *c d* represent the opposite points touching an outline; if a pressure in the direction of *e e* be made against the paper, it thrusts forward the point *f* in the curved line to *g* in the dotted curve, though the points *c* and *d* remain unchanged and equidistant. Perpendiculars from the curved line would, on the dotted curve, be wider apart from *c* to *g*, and closer from *g* to *d*. To this distortion, the less offensive name of foreshortening has been given, but as no change in the outline takes place, it is obviously distortion." This creates false shadows by the undue crowding of the lines on the shadowed side. "I will now describe the new machines, for I am acquainted with two; both of them obviate the distortions produced by the old machines; one is the invention of Mr. Bate, optician, in the Poultry, who has taken out a patent for the improvement, and spent large sums in bringing it to its present perfection. The other machine I have been allowed to bring with me, the better to enable the Committee to understand its principle, which is the same as Mr. Bate's, but differently applied; this machine has been very recently invented and made by Mr. William Froude, a son of Archdeacon Froude, a young engineer of great promise. As all the correct engravings placed before you were, however, produced by Mr. Bate's machine, I shall refer to his, by which, three years ago, Mr. Bate engraved for me a head of Michael Angelo for the card of the Graphic Society. Instead of the vertical section of the medal, as shown at D, fig 2, Mr. Bate takes the section that is formed by a plane at the angle of 45°, E E. The result is, that instead of the tracer passing in a straight line across it, as at H I, you here get a curved line over the medal from H to K, which curved line actually represents (if the tracer pass over the medal at an angle of 45°,) a curved line on the plate, which is exactly equal to a line on the field of the medal, which is constantly perpendicular to the curve traced on its surface. In proof of this, I place the oblique section on its base, and trace with a pencil held perpendicularly to the base curved line of the relief, which the obliquity of the section presents; the line thus traced on the base perpendicular to this curve is exactly the same as the line traced on the copper plate by the etching point; thus both the tracing and the etching points coincide in their curves, instead of, as in the old machines, where the lines directed to the base by the tracer were straight, whilst the etcher represented the curve of elevation, the whole amount of the difference being error." The elevation of 45° is most advisable, because the tracer then extends laterally as far upon the surface of the medal as its perpendicular at that point is from the base or field of the medal. The etching point and the tracing point move by the same adjustment for the spaces between each line. Mr. Froude's machine is not so readily adjusted as Mr. Bate's, but both obtain the angle of 45°, so necessary and valuable in making the tracer and etcher perform exactly the same curve. Witness produces an engraving of a large medal of Henry IV., which was commenced at four o'clock on the previous afternoon, and traced upon the etching ground by two o'clock on the following morning; it was then bit in with acid, still, under all all the disadvantages of haste, it is a faithful representation of the medal. In comparing two heads it was found, that the one engraved by the new machine looks you in the face, whilst the one by the old looks askance; a distortion consequent upon the use of the old machine. The French renders the error less offensive by adjusting the etching point so as not to give the full height of the relief; to prevent the effects being too offensive in subjects of high relief, in some instances one-third only of the elevation has been allowed; but the whole amount of that third is error. Another error grows out of this correction, the falsely representing the height of the actual relief of the medal. The principle of the construction of Mr. Bate and Mr. Froude's machines is the only way in which medals can be accurately engraved. An ordinary engraving does not represent a metallic surface: the engraving by Mr. Freebairn, for instance of Sir J. Soanes medal, may be an engraving of apainted portrait; there is nothing hard, nothing metallic in its appearance to represent a medal; these are characteristic qualities which can only be produced by the machine; in delicate works, however, a little touching with the graver would be found necessary to aid the details of the work. The new machine is incapable of improvement in principle, though, in some details, improvement may be suggested. The difference between Mr. Bate's productions and the French is, that the French have been under the superintendence of skilful persons, while Mr. Bate has been unaided by the judgment of artists. Mr. Bate has generally thrown his light on the front of the face, while the French have skilfully thrown the light on the back of the head; and if they had had an accurate mechine for this work, they would have approached perfection. The light depends upon the direction the lines traverse the medal; it always falls at right angles to the line traced. Even in low relief the French machine is bad—not a line out of the straight line can be drawn by that machine which is not erroneous. The Ariadne, witness was informed, had been sent to France

with a request that they would produce a specimen of that gun; it was sent as a challenge to Messrs. Collas's establishment, but it has not been accepted. Thinks a publication of the medals in the British Museum, under the patronage of the trustees, would pay its expenses after a short time. The head of Minerva, the seal of the Athenæum Club, for which Mr. Lane charged forty guineas; Mr. Bate said he would engrave for *1l.*; if a number were to be done, one half of this would be sufficient, taking the average at two inches diameter: 1*l.* per medal, obverse and reverse.

Mr. John Doubleday

Has permission to take casts from the coins, medals, and cameos in the British Museum. Has examined the engravings by the French machine with the medals; in many cases they are very much out of proportion. In a large medal of Peter Jeannin, about six or seven inches across the field, the amount of distortion—the face contracted and the head lengthened out at the back—was about a quarter of an inch. Has examined the engravings produced by Mr. Bate, and measured them with compasses, and found them perfectly correct. Thinks medals would not be injured by one or two casts being taken from them; but if many were taken, there might be a trifling impression upon the sharp parts.

John Henning, Esq.,

Has attended a good deal to bas relief, and executed a series of works from the Panathenaic frieze. Has paid a good deal of attention to both the old and new methods of medal-engraving by machinery: his works in the Parthenon and Phygalean marbles have been engraved by the old process, and the work is at this moment going on in Paris. Produces a cast from a part of the frieze, but it is not so perfect a cast as that from which the French engravings must have been made, because that was a cast before the engraving was quite finished. Mr. Bate's engraving was taken from the imperfect cast; it was done in four or five hours—taken from witness at eleven o'clock in the morning, and he saw an impression of it before five in the afternoon. Produces that impression. The point of Mr. Bate's machine works upon an enamelled surface, and, therefore, with greater accuracy; there is no metal sufficiently strong to resist the point without a slight impression, and accounts for the many inaccuracies in the French work, from the circumstance that they are done with a substance that is not hard enough to resist the point. Thinks it difficult to say whether a Medallic History of England would answer as a commercial speculation, because there is very considerable expense incurred independently of the engraving. You must have correct impressions of the medals in a substance that will resist the point. If the medals of the Museum should be to be done—to ascertain the individual who may be able to give the most perfect facsimile of them, witness would propose that whoever could give the best facsimile of any of the coins fresh from the mint, (which would give the clearest indications of any injury either on the coin or the cast,) should have the making of the casts. In fact, it is impossible to engrave them correctly with the machine without the most perfect casts. Witness's works have been pirated all over Europe; the gentlemen of Paris have engraved them, after he had wasted years of his life upon them. Sent over a letter to Paris, complaining that it was not decorous to publish his work without recognising his name—for, on examining one plate, his name had actually been expunged. They sent him thirteen copies; but what is that compared with the hundreds they have sold? The material of which his own casts consists, is enamel or crystal, the hardness of which exceeds that of any other material employed in similar works. Does not know of any substance so capable of giving a fac-simile impression except type metal, but that is too soft for the point of the engraving machine. It is rather an expensive process making casts in enamelled glass, for you require first to make the mould itself, and then it has to go through a chemical furnace; and you must take the impression while it is in a state of fusion: the mould does only once. When he first saw the French work, from the intimate knowledge of his own work, he was surprised at the monstrosity of the faces which were done in front; some which were done looking up, in these engravings were looking down, and distorted; attributed this to bad casts; but finding this error the same in all the front faces, was assured that there was something wrong in the machine. The evidence of Mr. Brockedon, has put this in the clearest light. A cast in enamelled glass would cost about fifteen shillings; according to the size the expense would be less.

Mr. John Bate.

Mr. Brockedon has so fully explained the difference between witness's machine and the French, that he has nothing to add.

Mr. Vincent Nolte, re-examined.

Accounts for the apparent discrepancy between the medals and the engravings of them executed by Collas's machine, by the shrinking of the casts in brass, from which the machine works. Mr. Brockedon is wrong in saying that there was not a corresponding movement between the tracing and the cutting points; the difference that may be found merely arises from the view taken by the artists of the manner in which the medal is to be engraved from the prospective view

taken of it. It is an error, also, to say, that the relief of the medal is lessened—the height of the relief is always given clearly. Mr. Bate's machine gives no relief at all. The head of Pierre Jeannin, which has been referred to, witness considers one of their best productions; its diameter is 7½ inches, and the engraving is less than the medal by three lines, that is 7¼ inches; it is in the highest possible relief, and one of difficult execution. There is no imperfection in the machinery, but merely a voluntary departure from that mathematical precision which might have been manintained if it had been thought fit. The cast shrinks sometimes more in one place than in another. It has been stated that a challenge has been offered to the French to engrave the head of Ariadne, and that the challenge hss not been accepted. Witness returns the compliment by challenging Mr. Bate to engrave Mr. Henning's cast taken from Stoddart's Canterbury Pilgrimage, equal to the engraving which he produces to the Committee.

Mr. Robert Faraday examined.

Casts in metal will become smaller than the mould, when cold.—a round article about 6 inches diameter will shrink about ¼th of an inch—it shrinks equally in all parts; in cases where there are greater thicknesses of metal at one part than another, the thickest parts will shrink most. In a medal of 7½ inches diameter, the contraction of a cast in brass would not amount to so much as ¼th of an inch. Does not think it possible that the distortion in the medal of Pierre Jeannin can be accounted for by the contraction of the metal—sometimes in casting, the flask overlaps a little, but that is bad workmanship.

Mr. Benedetto Pistrucci, Chief Medallist at the Mint.

Both Mr. Bate's and the French machines are very clever, but each of them is deficient in that which makes the chief merit of the other; the French machine is beautiful and admirable for effect, and gives a correct idea of the work, but in a perspective view, or forshortened; not as a medal would be seen looking at its centre, but in *chiaro-oscuro*. The English machine gives it straight, but the engraving is flat and hard. Does not think the French machine produces any distortion—it is like looking at a colossal statue, and taking a drawing from the place where you stand. The machine acts upon the same principle, it gives you a point of view, and if you take it from one side or the other, you foreshorten the distant side. The English gives the view more straight, but there is no relief. If it were possible to unite the two machines, that would be the perfection of the thing.

Mr. John Wilson, Gem Engraver.

Executed two casts of the Cheselden medal in enamel for Mr. Bate—they cost 1*l.* each; enamels in glass give a very accurate representation of their original—could not take a cast so large as the Napoleon and Marie Louise medal. Comparing the two engravings of the Henry the Fourth medal, the English appears to give an exact representation, which the French does not, though it has the more pleasing effect.

THE FRENCH PIRACY OF MR. HENNING'S WORKS.

Dear Sir,—I observe you have copied into your pages an article which appeared in the *Athenæum* of October 1, accompanied with an engraving of a part of my miniature sculptures after the Phygaleian marbles, executed by means of the French machine of M. Collas. A more unjust attack on British artists than the whole of this composition—a more insidious and cowardly effusion, I never read; the author, as if ashamed of his handywork, has not dared to affix to it his name. He has noted with care the names of artists long dead, but has intentially *suppressed* mine. The injustice is the more flagrant, when I reflect on the foul robbery and shameless appropriation of my laborious works from the Parthenon and Phygaleian marbles, by the company designated by the writer of the article as "*A few French gentlemen, who, with the aid and under the direction of some of the first French painters, sculptors, and engravers, united under the firm of Lacuevardiere and Co.*"

I should have expected from a company of such high pretensions, that they would have presented the public with something original, but in this I have been mistaken; for instead, it doth verily appear that their trade is to pirate the works of artists of humbler pretensions, and garnish themselves with the spoils of industry; nay, to conceal the very names of those to whom they owe their momentary fame.

The great object of the writer seems to be to depreciate Mr. Bate's machine, and emblazon the merits of that of the Company of *French Gentlemen*. This, however, is most awkwardly done; for instance, no artist of right mind would say of a copy from any respectable work, it "is to be judged by a pair of eyes, and not by a pair of compasses." The compasses were not used until the party had impudently denied that the French works were inaccurate; they were then used, to prove what any correct eye could see was distortion. If such evasion could be allowed, why that complicated labour to obtain accuracy through square lines on the original, and reduced ones on the copy, to the great annoyance of the draughtsman? Is not this all for the very purpose of geometrical correctness?

But our sage writer holds correctness of drawing to be a very subordinate matter, and maintains that "the proprietors are prepared to prove that the style of execution which they have adopted has been a matter of choice, and not enforced upon them by any defect in the machine." Well, let me notice the print published with the *Athenæum*. Assuredly the *Company of Gentlemen* did not advise with the first painters, sculptors, and engravers, regarding the finishing of this print. It does not exhibit the true effect of light and shade in any possible predicament. In some places the light comes from below, in others from above; while the light on the face of the figure, in the centre of the piece, kneeling, is like a transparency lighted from behind. By comparing the prints with the original casts, particularly in respect to the treatment of the front faces, it will be found that they are as unlike to those in the casts as a squeezed orange is to one that is plump and full.

When I saw the first specimen of this French work at Mr. Moon's shop, having the cast in my pocket, I compared them, and was not a little indignant to find my name obliterated in the engraving. I have the same impression still, because I found my private mark very distinct on the print; this I do consider dishonest. But, after all, what was this compared to the wholesale appropriation of my works for the profit of this "Company of French Gentlemen" (gentlemen, indeed!)—to the ruin of the legitimate sale of my work, and the blasting of my reputation as an artist—

> "Who steals my purse steals trash,
> But he who filches me of my good name,
> Robs me indeed——"

This "Company of *Gentlemen*" published my works without my leave, and, after abusing, sell them to my injury.

On the first appearance of the *Tresor Numismatique*, I was struck with the inaccuracy of the work on comparing it with my casts; and being fully aware of the difficulty of making a correct copy, I did expect at least geometric accuracy from a machine, which I am now told was under the direction of the first French painters, sculptors, and engravers. I attributed the discrepancies which I observed to the imperfections of the casts which had been used by M. Collas, and to the cupidity of the Company, not wishing to go to the expense of casts from my original moulds; under this impression, and thinking that this work might injure the sale of my own, I wrote to M. Lachevardiere, stating that it was not so much on account of the sale of my casts as the suppression of my name, that I felt aggrieved. He wrote me a very civil letter. I had threatened to apply to the Chancellor for an injunction against the sale in this country of that part of the *Tresor Numismatique* which contained my work from the Parthenon and Phygaleian marbles. He gravely replied, that the matter concerning which I had written was an affair with the publishers in London; but he very politely proposed to send me thirteen copies (one on China paper), and that they should be delivered free of expense. Liberal compensation, certainly! As it was, the packet cost me 17*s*.

Having spoken before the Committee of the House of Commons on the British Museum of the unjustifiable omission of my name in the letter-press of the *Tresor Numismatique*, Mr. Nolte contradicted my statement; but I maintained the fact, because I had in my possession the edition of 1834, in which it is not. A few days after the examination, Mr. Nolte called upon me, and begged to see my copy of the *Tresor*, which he opened, and said that he would show my name in it. Disappointed at finding that I had been correct in my evidence, he then said, "I have brought a copy with your name in it. Now, I ask, will you do me justice." I answered, "With all my heart, if you can show where I have been unjust." He then resumed:—"Here is a sketch of a letter which I wish you to copy, to sign, and direct to Mr. Estcourt, Chairman of the Committee on the Museum." I read it hastily, and finding the gist of it to be that I had now seen a copy of the *Tresor* with my name in it, I copied the letter without hesitation, signed, and directed it to Mr. Estcourt, and delivered it to Mr. Nolte.

I now look upon this as a trick by a party who would impudently thrust his imperfect efforts on the British public as the perfection of this class of art. This letter, I am informed, is now shown about with the edition of 1834, with the intention of impugning the veracity of my evidence in the Committee. But my statement regarded the edition of 1834, being the only one I had seen, which is still in my possession. The shame of having done me injustice, seemed at last to have struck the Paris Company, for the later edition contains my name, of which Mr. Nolte gave me a copy as a decoy to get the letter to Mr. Estcourt. By this *unworthy manœuvre* was the letter obtained, which is now shown about with the last edition to convey the impression that I had deceived the Committee. Is not this dirty work?

It is thus I am noticed in the latter edition:—"Long-temps on a cru que ces tables n'offraient entre elles aucune cohesion necesaire, et qu'il serait impossible de retabler la composition originales, en justifiant le rapprochment des diverses parties. C'est sous l'influence de cette idee, propagée par les editeurs de marbres, M. Wagner et M.

Combe, l'un des conservateurs du Music Britannique, que M. Henning a exécuté la raduction d'apres laquelle nos planches ont été gravées."

["It was long thought that those marbles had no indication of any necessary connexion; and, that it would be impossible to restore the original composition, so as to justify the union of the various parts. It was under the influence of this idea, propagated by the first editors of the marbles, Mr. Wagner, and Mr. Combe, one of the conservators of British Museum, that Mr. Henning has executed the reductions from which our plates have been engraven."]

It is, surely, a most strange thing first to assert that a certain thing is *impossible* to be done, and then that it was under this idea that I had done the reduction from which the plates had been engraven!!! It was, indeed, impossible that I could be influenced by the ideas of the gentlemen mentioned, as I knew nothing of their ideas on the subject of connecting the scattered fragments of the Phygaleian frieze. I took it as it stood in the Museum, and numbered it accordingly. My most serious labour was making the drawings, and restering the panathenic procession of the Parthenon; and it had no connexion with the ideas of any man, but was induced by serious reflection on Greek art, which, even in desolated fragments, commands the admiration of mankind. While engaged upon my drawings at Burlington-house, surrounded with isolated fragments of the renowned sculpture of Greece, often has it come from the fervid impression of my excited mind, "Could each mutilated piece tell its tale, what posing questions for the antiquary?" I had not seated myself long among the old stones, when, hastily glancing over them in a kind of stupor caused by the frightful confusion around me, I said, "Minerva herself might be puzzled to put these in order." I remembered that I had seen, early in 1811, among Lord Elgin's collection of drawings, Sketches of the Frieze, by Jean Carré, a French artist, done between the years 1674 and 1678, some years previous to the destruction of the Parthenon by the Venetians. I examined those sketches with care, after having done the west frieze, and I found them perfect, as I thought, for the arrangement of the east frieze, which contains the twelve Dii Majores of antiquity and attendant ministers, to which the whole procession is directed—that of the south side, as if going to the right, with eight bullocks in front at the south-east angle of the temple—that of the north, as if going to the left, with four bullocks, a ram, and a hog, at the north-east angle of the temple. Without the sketches of Jean Carré, my arrangement of the procession could not have been done. The curious and intelligent may form some idea of the difficulties I had to encounter in so complicated a case, by examining the frngments themselves, and J. Carré's imperfect sketches; but it is impossible for any person to form any adequate idea of the toil of body and mind, which I endured in the completion of that work. But, alas! it never entered into my calculations, that the work would attain such importance as to tempt the cupidity of a Company of French Gentlemen, who, to give eclat to their work, pretend to be directed by some of the first artists of France.

Another atrocious piracy of this "Company of Gentlemen" is the seizure of a work (the "Canterbury Pilgrimage,") by my late son, Samuel, who fell in the pestilence of 1832. It is said that from 1500 to 2000 copies have already been imported into Britain, and sold at 7s. 6d. His widow, with two helpless orphans, has been insulted by the offer of a few copies—bits of paper that might cost the Company a shilling a piece.

I now call upon the artists of every land, from the eastern extreme of the old to the westernmost boundary of the new world, to consider whether the institutions of civilised life ought not to protect universally such works from spoliation?

I will only add, that having got sufficient evidence in specimens of the superior geometrical accuracy of Mr. Bate's machine, I have determined to have my works from the Parthenon and Phygaleian marbles, done in a superior style by his machine, as well as the Cartoons, and the Transfiguration by Raphael; which shall be immediately announced, with terms, by public advertisement.

I am, dear Sir, yours, truly,

JOHN HENNING.

17, Lower Belgrave-place, Pimlico,
Dec. 15, 1836.

THE DISTANCE TRAVELLED BY MR. GREEN'S BALLOON IN ITS GREAT CONTINENTAL EXCURSION.

Sir,—Your correspondent, O. N., who in your December No. apologises to Kinclaven for being wrong in *latitudes*, &c. goes on to say, that my friend Mr. Williams's solution of the distance that Mr. Green's balloon travelled "*is perfectly false;*" and concludes by hoping that his discovery will be an atonement for his (O. N.'s) former error.

With every respect and good feeling towards O. N., I think (with my friend, the actuary) that his error was not in the *method*, but an *omission* of part of the

calculation; and I contend, that O. N. is again a little out of his *latitude*, in making use of so strong an assertion, and that it can scarcely be considered (which he wishes it to be) an atonement for his former error.

I beg to hand you Mr. Williams, the actuary's, amended solution, which I think O. N. will find correct—and to whom I feel obliged, for pointing out the mistake in the former instance, but not in his *method* of doing so,

I am yours very faithfully,
RICHARD EVANS.

8, Castle-street, Swansea,
Jan. 13, 1837.

To Mr. Richard Evans, Castle-street.

Dear Sir,—A few days ago, while indisposed, the *Mechanics' Magazine*, of 3d Dec. last, was shown me, in which was a solution you had in a friendly manner caused to be inserted as my production; and I am truly concerned that my attention to your little query did not better deserve your opinion of my knowledge of figures.

I recollect that when your question was brought me, I had no idea it was for any other purpose than momentary curiosity; and my thoughts, also, were then altogether engaged in making up several large accounts, so that in my haste and absence of mind I omitted a material number, which would have rendered the whole correct. I never thought of the thing since until shown me in the Magazine.

I subjoin the question, and the solution corrected. Perhaps the Editor will favour you with the insertion at his convenience, merely as an apology for the late error; and to show, that the error was not owing to the *method*, but owing to the *omission* of the calculator.

Dear Sir,
Yours faithfully and obliged,
J. W.

Question.—How far asunder are two places on the globe, one of which is 5′ W. and 51° 31′ N.; the other, 7° 52′ E. and 50° 16′ N.?

To	7° 52′ E. long.	From	51° 31′ N. lat.
Add	5 W.	Take	50 16
Sum	7° 57′	Diff.	1° 15′
	60		60
	477 miles diff. long.		75 miles diff. lat.

The natural cosine of half the sum of the given latitudes is ·6307887.

Then $\sqrt{(\cdot 6307887 \times 477)^2 + 75^2} = \sqrt{96157{\cdot}51} = 310{\cdot}09$ Geographical, or 359·18 English miles.

Note.—The above is a common little problem; may be found in most treatises of practical trigonometry; and generally the *first* in mid latitude, or Mercator. Of several methods, I chose the above for simplicity and dispatch, it requiring only one reference to a table.—J. W.

A VOICE FROM THE SHOP-BOARD.

Sir,—In No. 694, of the *Mechanics' Magazine*, (which I have not till recently met with,) a correspondent describes an invention, which he considers would be a great improvement on the *tailor's shop-board*. Being one of the fraternity on whose behalf he has so benevolently exercised his genius, although proverbially but a fraction of human nature, I thought I should not be exceeding the characteristic pretensions of my calling, if I ventured to exercise the small portion of capacity assigned me of that nature, in examining and judging of the utility and merits of the invention. In doing this, although I would give the author due credit for his good intentions towards even the very fragments of his species, I cannot but regret he has employed so much of his time and talent to a purpose which shows him to be little acquainted with the real *desiderata* of the trade so contemptuously stigmatised. There are thousands of journeymen tailors in Lon-

don, now destitute of employment, who would have esteemed your correspondent as a great benefactor, if, instead of inventing for them a new mode of setting to work, he had found them work *to do* in their *own accustomed fashion*: and any of these, if consulted, will inform him that there are *far worse evils* to be borne by them than the supposed injuries and inconveniences resulting from a cross-legged posture. The invention of your correspondent is not only formed on very erroneous notions of the trade, but is altogether inapplicable. The injurious consequences he ascribes to the present mode arise from a different source, where they exist, and are incidental to all sedentary employments, where want of fresh air and exercise are to be complained of. That tailors are much subject to pulmonary and other complaints, in crowded places, is not owing to the manner of sitting, but to the length of time they have to sit together, in a room, the temperature of which (if in London) is much higher than the external air. To be confined in such a place the whole of twelve hours, with only one interval of an hour, which is at dinner time, must certainly be, in some respects, injurious to health; but not, I believe, so much as your correspondent imagines. In the country these evils are not so much the subject of complaint; and even in the cases referred to, the adage "what can't be cured must be endured," will still have its use, for what advantage your correspondents remedy holds out.

The mode of sitting, so long in use amongst tailors, is, according to a provision of nuture, without violence to the laws of physiology; nor can any plan be devised by which they could perform their work with greater facility and convenience. It does not tend to distort the bodily frame, but rather to rectify distortion: for instances have been known of crooked-legged boys having become straight by their being apprenticed to the trade. In fact, the principles of anatomy, as exemplified in the ball and socket articulation of the thigh and hip bones, are favourable to the posture alluded to; and, unless at the commencement of a lad's apprenticeship, there is no ill effect or inconvenience felt from it. But the method recommended by your correspondent, if it could be brought into practice for the sake of trial, would not only prove inconvenient and tiresome to the limbs, but would not enable the workman to execute his work with any degree of skill, neatness, or expedition, particularly as to the *pressing* part of it. By the cross-legged situation, he can use his iron with proper effect, because it is a mechanical operation, (do you laugh, reader?) which requires not only the weight of the *machine*, (spare your risibility,) but a considerable degree of manual force, which could not be adequately exercised by the cushion plan: as it is well known that the more the arms are extended, the less they are within the line of direction for effectual movement; the law of gravitation retarding or aiding in proportion. With regard to the sewing process, the plan suggested is still more objectionable. By the present mode the work can be managed and acted upon (save the mark!) to the greatest advantage, and without straining exertion, because it is placed on the knees, immediately under the eyes, and within the esaiest exercise of the hands. But supposing, for the sake of argument, the invention could be used by one or two individuals, how could it be applied in shops in which twenty, thirty, or forty men (if I may be allowed to use the term) are employed? The space required, as far as I can understand the description of your correspondent, for one man, would occupy the room of several, as now used; and on that account the invention would require enlarged dimensions in whatever shop it might be adopted. In fact, it appears to me impossible to bring it into use where more than one person would have occasion to sit, even supposing it calculated to answer the purpose for which the invention intended it.

Before I quit the subject I cannot help remarking, as not a little curious, that while one man attempts to remedy, by invention, *imaginary* evils for the poor tailors, another, by the same expedient, is making his fortune by bringing *real* ones upon them. An article of dress, called a *Mackintosh*, (after the name of the inventor,) more like a smock-frock than a coat, and which gives the wearer more the appearance of a smuggler, or Smithfield drover, than that of a gentleman, bids fair to supplant the well-shaped top garment with which nature, in many cases, has been improved by the unfortunate wights, of whom thou-

sands must now be sufferers in consequence. The innovation, however, it is rumoured, is found to be objectionable on several grounds; and it is hoped that a desire to return to the wear of the respectable-looking upper-benjamin, for the sake of giving due advantage to the human shape, will again soon bemanifested.

ONE OF THE INJURED.

STEAM COMMUNICATION WITH INDIA.

Sir,—The attention given by you to the subject of steam communication with India, is deserving the gratitude of those interested in this measure, and particularly the mercantile classes of society. The merits of this case are now so fully known as to require no comment. The benefits to be derived from such a measure are attested by India, and are daily becoming more important in the eyes of all classes in this country. It may not, however, be generally known that an association has been formed, and considerable subscriptions entered into in London for carrying into effect this desirable object. * * * No objection has yet been urged to the plan—the means of carrying it into effect are ready. It is, therefore, matter of some surprise, as well as of reasonable complaint, that the necessary sanction of Government is still withheld. We know, indeed, that a body of men who rule the destinies of millions of our fellow subjects have hitherto affected to treat lightly this important measure; and we know, too, that in excuse it has been alleged that our exports to India have already attained their maximum, and that, consequently, they would not be increased by regular communication, and the means it would give of extending commerce and obtaining information as to the wants and resources of those countries. In reply to such arguments, I would ask, what has been the result of opening the trade with India?—and I would take the article of cotton, in respect to which, before that experiment was tried, it was maintained, because cotton was the growth of India, it would be manufactured cheaper than it could be exported from this country. Let us see the result. The amount of cotton-stuff exported to the Company's territories in 1814, the year free trade was opened, was no more than 109,000*l.*, the same articles exported in 1822 had reached upwards of one million sterling in value, and in 1832 this amount was increased to nearly two millions of our money. If such result has here produced capital and enterprise, being admitted in a partial way to the East, what may we not expect when every island and continent between British Malta and British Australia, becomes the seat of commerce, and has its resources known to the people of England? No less than this comprehensive plan is proposed by the merchants of this country. The Euphrates project is abandoned, and this is a resolution of a Committee of the House of Commons in favour of the communication to India and the East by the accessible route of the Red Sea. Let us hope, therefore, that official etiquette or mischievous monopoly will no longer be permitted to stand in the way of so useful an undertaking.

I have the honour to be,
A FRIEND TO STEAM NAVIGATION AND TO INDIA.

[We have taken the liberty to omit from the preceding letter the resolutions of the East India and China Association, which have been already duly noticed in the *Mechanics' Magazine* (p. 304). The project alluded to by our correspondent appears to be that of the "East India Navigation Company," which must be generally known, at least to our readers, since it was referred to in the review of Captain Grindlay's pamphlet (p. 377). It was there remarked, that it was to be lamented the estimates of the Company should be *in appearance* so much at variance with those of the Madras Committee. The difference is in reality very trifling. The Madras Committee calculated that the whole expense to be encountered in the completion of the steam-line, by extending it from Egypt, where it at present stops, to India, would be 22,000*l.* per annum:—the Company are willing to undertake the establishment of steam conveyance the whole way *from England* to India on an annual sum of 65,000*l.* being guaranteed to them; but this sum would also include their remuneration for performing the packet service between Falmouth and Alexandria, which now costs Government 40,000*l.* a year, so that the additional expense in the case would be only 25,000*l.*]

THE ELECTRICAL THEORY OF THE UNIVERSE.

Sir,—Being at present engaged upon a particular subject, which engrosses almost the whole of my attention, I have been anxious to avoid discussion upon the electrical theory; but seeing that some of your correspondents have, in consequence of the publication of my attempt at perpetual motion (which, be it remembered, dates about fourteen years ago), taken up some very erroneous and, as it appears to me, superficial notions with respect to that theory, I am induced to offer some further remarks, with a view to remove these erroneous impressions. I have no wish to enter into any controversy with Trebor Valentine, upon the merits of the wheel in question, if it has any; although I must say that the view which he takes of it is not complete. When he says that "the friction between the ball and the wheel is greater than the friction on the axle of the wheel," his view is correct; but not so when he says "that gravity is completely neutralized by the power of the magnet."

However, I do not intend, as I have said, to discuss the merits of the wheel; my present business is with the concluding sentence of his short article. He says, "But the most extraordinary part of the affair is, that a rational being could be led by the failure of so futile an attempt, to conclude that *gravity*, in the hands of the great Creator, is insufficient to produce *that* (a perpetual motion, I presume) which he in his experiment had taken the most effectual means to prevent." (Vol. xxvi. p. 315.)

Now stop, Trebor Valentine. Who informed you that the Creator *intended* that the motion of the earth round the sun should be a perpetual motion? If the motion of the earth round the sun is never to come to an end, then it never had a beginning; and its motion, upon that supposition, cannot be accounted for by any known laws in natural philosophy—it is a standing, or rather a moving, miracle.

Again, that which is subject to change, that change continually tending to one point, cannot endure for ever. Geology teaches that the earth is, and has been for a long series of ages, tending to solidification; and if the earth is to remain for ever, this process must go on for ever, which is absurd.

But this process of solidification must have had a beginning; however far back we may choose to fix that beginning, we come to a resting place at last. Infinite expansion or infinite contraction equally involve an absurdity.

Now, the point upon which the whole argument rests is simply this:—*Is the earth tending to solidification?* Geology says, in language which can neither be misunderstood nor misinterpreted, that this process has been going on for ages, and is going on still. Now, those who contend that the earth is to revolve for ever at the same distance from the sun, have to prove that geological facts are not facts, which I apprehend will be found somewhat difficult.

Trebor Valentine and *Nautilus* appear to labour under an impression that the perpetual motion of the earth was doubted, *because* the wheel and magnet had failed to produce that effect. This impression is altogether erroneous; these doubts rest upon much surer grounds. If Trebor Valentine, or any other of your correspondents, will refer to the reports of the lectures delivered upon the electrical theory, he will there find some remarks with respect to motion, which I think will set him right upon that point. (See *Mechanics' Magazine*, Nos. 687 to 692.)

It is not to be expected that either Trebor Valentine, or any other, should give up their preconceived notions all at once; but I should think that the controversy that has been carried on by your talented correspondent, Kinclaven, might have shaken his confidence in some of the existing opinions upon physical subjects.

It is some consolation, amidst the puerile nibblings of contemporaries, to find that so distinguished a philosopher as Sir Isaac Newton, for whose opinions I entertain the highest respect, although I do not hold him to be infallible, entertained notions almost exactly coinciding with those advanced in the electrical theory. A friend has put into my hands a pamphlet, in which I find the following words, as related by Newton's friend and relation, Mr. Conduit:—"He (Sir Isaac Newton) repeated to me very distinctly, that the vapours of light emitted by the sun, which had their sediment as water

and other matter, had gathered themselves by degrees into a body, and attracted more matter from the planets, and at last made a secondary planet, and then by gathering and attracting to them more matter became a primary planet, and then by increasing still became a a comet; which, after certain revolutions, by coming nearer and nearer to the sun, had all its volatile parts condensed, and became a matter fit to recruit and replenish the sun, as a faggot would the fire if put into it."

All the difference, then, between the opinions entertained by Newton, and those advanced in the electrical theory, is, that he considered that planets become comets, whilst, in the electrical theory, it is contended that comets become planets. If the process of either theory be reversed, they will be found identical. A little geological knowledge is sufficient to determine in what direction the process will terminate.

Yours respectfully,
T. S. MACKINTOSH.

NEW SCIENTIFIC ANNUAL.

A good Annual Register of Science has long been a desideratum. Dr. Thomson, whose monthly periodical, the *Records of General Science*, we noticed with as much approbation as could reasonably be extended towards it, on the appearance of its first number, has endeavoured to fill up the void by the publication of a volume of rather diminutive appearance,* and very neat exterior; but we are afraid the article required is not yet in the market. From his second title, "Epitome of the Progress of Science," the reader is naturally induced to expect the very thing which has so long been looked for in vain; the body of the work, however, by no means makes good the promise of the title page. It opens with a "Calendar for 1837," which is followed by a long array of tabular articles, whose subjects bear no particular relation to the "time present," and might as well be treated of in works of the most permanent and improgressive character: many of them, in fact, are old favourites, who have already "done the state some service" in divers situations; such are the "Tables of the Heights of Mountains, of the Comparative Elevations of celebrated Buildings," &c., to say nothing of the "Divisions of Time," and the "Elements of the Solar System," which are, of course, to be met with at the very threshold of every school book of Astronomy. The remainder of this first part is impressed with an air of Frenchification which appears rather ludicrous when taken in juxtaposition with the rather gratuitously *national* leading title of the book; but which is fully accounted for by the very candid admission of the preface:—

"The present attempt at supplying a scientific Annual to the British public originated in a suggestion made by the publisher to translate the *Annuaire par le Bureau des Longitudes*, a periodical which has acquired much popularity among our neighbours. Upon mature deliberation, the plan of the following work was adopted. Many of the tables comprehended in the first portion of the work have been reduced from the *Annuaire par le Bureau des Longitudes*, and likewise from the *Annuaire de l'Observatoire de Bruxelles, par le Directeur A. Quetelet*—and as they are all of a practical nature, it is hoped that they will be found useful to a large circle of society."

Of a "practical nature" many of the tables are, but we rather doubt the utility of many of them to a "circle of society" peculiarly British, such, for instance, as that for the conversion of old French weights into new, and the succeeding one for converting new French measures into old,—those for reducing the degrees of the centigrade thermometer to those of Reaumur, and a number of others which must have found themselves much more at home in the pages of the foreign *Annuaires*, than in those to which they have been injudiciously (because to the exclusion of more appropriate matter,) transferred. It is difficult, also, to imagine the practical usefulness, to a tarry-at-home reader, of the lists of the passes of the Alps, the Pyrenees, and the Cordilleras, and, always bearing the title in mind, rather ridiculous to turn over page after page, filled with tables of the weights and measures, not of our own country only and of France, but of Germany, Sweden, and Portugal, especially as due care is taken to give their relative values in French as well as English equivalents.

* The British Annual, and Epitome of the Progress of Science. Edited by Robert D. Thomson, M.D. London: 1837. Baillière, 12mo. pp. 375.

Altogether, Dr. Thomson's little work for a "*British* Annual" must be allowed to have *foreignism* enough about it: principally translated, as the advertisement informs us, from two French periodicals, at the suggestion of the publisher, who, strangely enough, happens to be a Frenchman, and, stranger still, has employed another foreigner—a German—as its printer! No wonder that its contents should be rather heterogeneous.

Among these tables there is one which affords a melancholy confirmation of the fact of the decline of science among us, —of astronomical science, at least. It contains the latitudes and longitudes of all the principal observatories of the world. The total number is sixty-six, and, out of these—will it be believed?—the British empire numbers *only twenty-one*,—not quite *one-third of the whole!* What a degrading picture of our wretchedness does this exhibit, especially when coupled with the melancholy consideration that eminent astronomers are at once so scarce, and our Government so niggardly in patronising science, that *such men* are employed as Professor Airy, at Greenwich, and Sir John Herschel, at the Cape of Good Hope! For all this, however, Dr. Thomson might as well have relieved the *meagreness* of his list by the insertion of a *few more* British observatories, the splendid (so called) private one of Mr. C oper, the member for Sligo, for instance, or that which has recently been established in the far-off regions of Bermondsey, by "the Southwark Astronomical Society," with the view, we suppose, of proving the decline of a taste for science among the middle classes of this benighted country. In sober earnest, the Doctor might easily have extended his already-ample catalogue, had it been required, in numbers, if not in range, though the latter is already wide enough, comprehending, as it does, points so distant (and can any other nation rival us here?) as Kensington and Madras, Cumberland and the Cape, Parramatta and Portsmouth, Bushey Heath and Saint Helena!" Details of this description are far more worthy of the room they occupy than the *Court Calendar* sort of lumber with which the middle portion of his book is filled, in the shape of long lists of the names of the worthy professors at various of the Scotch Universities, at the medical schools of Paris, the Polytechnic School, &c. The sketches of the American colleges are rather more interesting, though sadly out of place; but nothing can be more completely thrown away than the many pages devoted to recording the names of the office-bearers of various scientific societies. The searcher for information, such as a "scientific annual," ought to supply, cares but little to learn the important intelligence that Doctor Stokes is President, and Doctor Styles, Vice, of the "Medico-Chirurgical Society." And after all, these lists are very incomplete.

The remaining portion—the only one which professes to supply an "Epitome of the *Progress* of Science," and also the only one of any pretensions to originality—is composed of five "reports," on the model of those which once promised to form so valuable a division of the Transactions of the British Association. The first of these is on "the Recent Progress of Optical Science," by Professor Powell, of Cambridge, who freely acknowledges his obligations to a paper on the same subject in one of the Association's Reports. The essay which follows—"Experiments and Observations on Visible Vibration and Nodal Division," by Mr. C. Tomlinson, bears the character rather of a paper fitted for a scientific magazine detailing individual investigation, than a report of general progress, like the article which follows it, from the pen of Mr. Woolhouse, of the Nautical Almanack Establishment. The longest and most elaborate is that of Mr. T. S. Davies, of the Royal Military Academy, at Woolwich, on "the Early History of the Magnetic Needle." Mr. D. has evidently paid very considerable attention to the subject, and we may expect a greater quantity of original information in his next paper (he purposes to give a regular series), in which he intends to embody the fruits of his own reading; his present one being, as he avows, almost entirely compiled from a letter by the late Julius Von Klaproth, whose researches into the invention and early history of the compass were most expensive and successful. Last of all comes the editor himself, with a "Report on the Recent Progress of Vegetable Chemistry," remarkable chiefly for the pedantic and unintelligible jargon in which it is composed. Dr. Thomson, by way of giving the

reader some idea of the rapid strides which chemistry is making, observes that, at the commencement of the century, we were acquainted with only twenty distinct acids, while, in the single year of 1836, no less than twenty-three new ones were discovered and described. He might just as well have told us of the supremacy of the present age in geographical discovery, because Captain Parry has made known to us a number of uninhabited islands in the Polar Seas, whereas Columbus discovered only one, America! Let us take his description of one of these newly-found "distinct acids:"—

"Tartrovinic acid. M. Guerin Varry, who is the discoverer of this acid, obtained it by boiling tartaric acid with absolute alcohol for a considerable time, neutralising the liquid with carbonate of barytes, decomposing the salt with sulphuric acid, and evaporating in vacuo. Varry has satisfied himself that the acid exists in the liquid before the addition of the barytes; and Biot has ascertained that it acts upon light with greater energy than tartaric acid does. When kept at a boiling temperature for ten hours, with forty times its weight of water, it is decomposed into alcohol and tartaric acid. When exposed to a strong heat it gives off water, acetic ether, acetic acid, carbonic acid, carburetted hydrogen, a volatile oil, and a substance,* *an alogousto pyro-acetic spirit:* charcoal, pyro-tartaric acid, and an oily substance, remain behind, &c. &c. &c."—P. 340.

A wonderful progress, indeed, must chemistry be making, when twenty-three *such* acids as this are discovered in a year; and not only discovered, but *described*. "Thereby hangs a tale."

"Varry considers its composition to be two atoms of tartaric acid, with one of ether and one of water. He gives us no numbers, however, except in the form of a complex formula, which rather tends to confuse than instruct when unaccompanied with the actual results of experiment. We trust that this practice, which is gaining ground in France, will never be adopted in this country. The expression of Dr. Dalton, at the British Association, that the sight of such chemical formulæ 'was enough to make one sick,' is strong but significant."—P. 341.

And truly significant, also, is this passage of the value of this division of the "Epitome of the Progress of Science," in which the details of the astonishing discoveries of the past year are obliged to be omitted as "tending rather to confuse than instruct." If this were a valid excuse, Dr. Thomson might have left out the whole article. Dr. Dalton's estimate of the emetic properties of the French chemical formulæ is doubtless correct, for the sight of the nomenclature alone is nearly sufficient to produce the pleasant effect he alludes to. Among the rest of the twenty-three distinct acids, we have three (all produced by some trifling variation), with the euphonious names of "Racemovinic," "Tartrocarbydric," and "Racemocarbydric;" and these names comprise pretty nearly the most important information afforded with respect to them.

It is only necessary, in conclusion, to mention the simple fact, that the British Annual, from beginning to end, does not contain a single word on the application of science to the useful arts. An "Epitome of the Progress of Science," for the year 1836, has not a syllable to say on the subjects of railroads, locomotive carriages, or even the steam-engine itself! "'Tis true, 'tis pity—and pity 'tis, 'tis true!"

* Sic in orig.

TAYLOR'S SCIENTIFIC MEMOIRS.

Mr. Taylor, the co-editor and printer of the *Philosophical Magazine*, has set on foot, with great spirit, a new periodical of considerable promise, of which two quarterly numbers, comprising the first volume, have already appeared. The want of such a work, devoted entirely to translations from foreign journals, has long been felt; and it is to be hoped that the editor, printer, and proprietor (*tria juncta in uno*) will meet with sufficient encouragement from the scientific world to enable him to continue his undertaking with the spirit it requires. Mr. Taylor's reasons for originating it will be best given in his own words: they read not a little strangely to ears accustomed to the incessant din of the "decline of Science in England," which it has pleased certain of our peevish philosophers to raise:—

"In order to bespeak the favour of the public to this new undertaking, I shall merely state that the want of such a work has been suggested to me, during a long connexion with journals of science, by my experience of the difficulty of giving to the English readers within the necessary limits

of those works, a sufficient view of the state and progress of the sciences in other countries. Short abstracts are given; and now and then entire translations of important memoirs; but *original communications* and the *scientific proceedings of our own country now occupy so great a space in our journals* as to make it impossible to do justice to the researches of foreigners." (Advertisement.)

Thus, the "Scientific Memoirs" will form a valuable, if not an indispensable supplement to all the philosophical journals of the day. The first volume* comprises translations at full length of fourteen articles, all from the French and German languages. We hope this is not to be taken as an indication that these are the only languages from which translations are to be made for the work; for, although a vast majority of the scientific memoirs of the continent make their appearance, at one time or another, in French and German, an acquaintance with other languages (Italian for instance, and occasionally all the others) is necessary to a complete view of the "state and progress of science", in the whole of Europe.

The great utility of such a work is fully shown in article 13 h "On the Conducting Powers of Bodies for Electricity," by E. Lenz, who favours us with a detail of the labours of two German philosophers, which, had they been before known in England, would have spared Dr. Ritchie a world of trouble in experimenting, as well as in propounding a theory which the extended experiments of Ohm and Fechner have (and had) demonstrated to be untenable. The same article furnishes a tough morsel for the *Declinarians*. Lenz recapitulates the names of the men of science to whose researches electricity is most indebted: they are as follows:—Van Marum, *Priestley*, *Children*, *Harris*, *Davy*, Galvani, Pouillet, Becquerel, *Christie*, Ohm, Fechner, *Barlow*, *Cumming*, and *Ritchie*. Fourteen of them altogether, eight of them British!

The "Scientific Memoirs" are well got up; the printing is, as it ought to be, unexceptionable; and the plates are very neatly executed. Take it for all in all, it is a work which ought to succeed.

* Scientific Memoirs, selected from the Transactions of Foreign Academies of Science, and Learned Societies, and from Foreign Journals. Edited by Richard Taylor, F.S.A., &c.: vol. I. London, 1836. Taylor, 8vo. pp., 348.

STRICTURES ON NAUTILUS'S MECHANICAL OBJECTIONS TO THE ELECTRICAL THEORY OF THE UNIVERSE.

Sir,—I never met with a more summary way of settling a question, or an argument rife with such sophistical declamation, and abounding with instances more calculated to defeat their own purposes, than Nautilus has sent forth in his letter in your Magazine, No. 697. He says, "I have admired the ingenuity with which Mr. Mackintosh has defended his new theory, but two matters have lately appeared which have tended to lessen my opinion of the depth and soundness of his views." Mr. Mackintosh cannot but deeply regret the loss of the opinion of so ingenious and scientific an admirer, who thus endeavours to correct an error into which, *in his opinion*, Mr. Mackintosh has fallen. Mr. M. adduces as an argument in support of his theory, that "if the moon revolve upon her axis, so also may a ball of lead attached to the extremity of an arm of a fly-wheel be said to revolve upon its own axis." The wheel being in motion, Nautilus says, *most certainly it may*, and so IT DOES, and *so do* all the particles of the said wheel, each on its own imaginary axis; he thus would prove it: "Let Mr. Mackintosh," says he, "be seated in the chair of a vertical 'merry-go-round;' so long as the chair maintains its parallelism, or *has* NO *rotation* on its own axis, the motion will be agreeable, but let the chair be made fast, &c." This being done, the chair bears an exact resemblance to the ball of lead; but let the chair be loose as before, and a ball of lead fixed to the opposite arm, the machine being in motion, the observer in the chair will perceive the ball during *only half* the revolution he takes. Now, is it the ball of lead or the chair that has *a rotation on its* OWN *axis?*—(it is clear *both* cannot follow the same law, or their relative position to each other would always be the same),—the ball of lead is obeying an impulse emanating from the axis upon which the wheel turns, while the chair is counteracting the effects of the same impulse by its rotation on its own axis.

There is a peculiarity in the operation of this machinery, which will be better elucidated by the following illustration:—The action of the chair is not *a positive*

but a negative rotation; thus, let the person occupying the chair observe a mark on the outer edge of the spindle or axis on which it is hung, he will perceive this mark to be continually running round the circumference of the circular provision made in the chair to receive the said spindle, and that every revolution the machine makes, the mark will have traversed the circumference of the hole, the chair at the same time being apparently motionless; then stop the machine, let the observer alight, and again produce the same effect while it is stationary; this can only be accomplished by causing the chair to revolve round the spindle—an absolute demonstration,—that whenever, and under any circumstances, such an event takes place, the chair *must have a rotation on its* OWN AXIS. Again, let Nautilus contrive that the chair be secured to the arm on which it is hung, while at its lowest depression; then let him elevate it to its extreme height—in this position it will be bottom upwards,—now let him release the chair, and he will have invincible evidence of its rotation on its own axis, by its falling into the position it would gradually have acquired during its ascent, had it been left to the control of its own action.

Again he says, "*If this suffice not*, let Mr. Mackintosh hold in his hand a bottle of port wine, with which he shall describe an orbit with its crusted side always opposite the flame of a candle; this may be done by the person holding it walking round the candle with the bottle between him and the flame; in this position it will resemble the ball. Now to the bottle securely fix a string, which must be attached to the stem of a candle. If the bottle in its revolution round the flame winds the string around it, then in its path will it have a rotation on its axis; if not, *vice versâ*, Did the bottle take up the thread, which it would do if made to describe an orbit in *common*, then would it revolve on its axis to a certainty; but in this case the similitude ceases, the bottle being an independent body, following its own laws of rotation, and the ball revolving round the axis of that body of which it forms but a part.

The last argument Nautilus adduces is foreign to the point in question, and which, as he is endeavouring to substantiate his position by a course of inductive reasoning, will signally fail. I will admit, however, for the sake of brevity, what he assigns, and take him upon his own grounds; namely, "that a small globe, having a string tied round its equator, and a piece of yarn attached to one of its poles, will, when caused to revolve by swinging it round by the equatorial cord, twist the yarn into a fairly-spun thread; thus it is proved to have a rotation on its own axis. Now, let Nautilus fix a piece of yarn to *his* axis of the ball of lead, and again to any other part of the wheel, if he waits for the spun thread in this instance, he must stay till the ball has rolled around it—the arm on which it is fixed, or two hills be created without a valley. One more illustration: let the person occupying the chair of the "merry-go-round," hold in his hand the same piece of yarn which, as in the above case, shall be fixed to another part of the machine; he will soon find the yarn become a fairly-spun thread. What better proof can be required, that the chair has a rotation on its own axis? How, then, can Nautilus so positively assert the ball to have a rotation, &c., when the practical results are so diametrically opposite in their effect? I have been induced to trouble you thus much, from no other motive than a desire to correct error whenever it is in my power; and were so scientific and philosophical a journal as is the *Mechanics' Magazine*, allowed to pass with so *mechanical* a blur upon its pages, I should fear for the enviable reputation it possesses. It is in consonance with this conviction, that these observations have been elicited. I trust, should you deem them worthy the valuable space they will occupy in your highly entertaining periodical, they will be a means of rectifying an erroneous impression, likely to be caused by the perusal of the letter to which they apply.

I have not the remotest intention to defend your very intelligent correspondent, Mr. Mackintosh, in this new theory; but when he is so unjustly attacked, and that in such *dogmatic verbosity*, I cannot resist the incliation to become a volunteer in his behalf. Is not opposition the whetstone of argument, and controversy the sport of truth? If so, good will accrue *from evil*, and Nautilus have no reason to regret the publication of his letter.

S. W. S.

Leamington, Jan. 28, 1837.

NOTES AND NOTICES.

Defective Vision.—It is well known that Goethe pursued for a series of years a course of experimen's in optics, which terminated, in his opinion, in annihilating the Newtonian system, the immortal author of which he took upon himself to treat with so little ceremony, both in prose and verse, as materially to lessen his own claims to respect. One investigation which he pursued, in conjunction with Schiller, was into the cause of that inability to distinguish colours, which appears to be one of the most common defects of vision (and which has been the subject of communications to the *Mechanics' Magazine* on the 3rd of December and the 21st of January last). The result at which they arrived is stated by Goethe in his *Tag-und Jahres-Hefte* (Day-and-Year-Papers, a sort of summary of the events of his life), to have been this—that in all cases this defect arose from an incapacity of perceiving one particular colour—*Blue.*

How to thaw Frozen Pumps.—Mr. Akrill, an ingenious mechanic of Boston, communicates the following simple method of thawing frozen pumps, and preventing them from freezing. Put a bung into the nozzle of the pump, and two or three handfuls of salt into the barrel: if put in over night, take out the bung, and pump out the salt and water, after which the pump may be used. To be repeated when necessary.

Removing Stains from Prints, &c.—We have received the following communication from an intelligent correspondent:—"I have, by accident, discovered what might be useful to some of your readers to know—that the clear solution of chloride of lime, diluted with twice its bulk of water, will effectually and expeditiously remove stains from prints and printed paper. Instead of the ordinary process, which is expensive and tedious, first soak the print in clear water, till it lies smooth; then remove it into a dish, large enough to hold it flat, filled with the solution diluted as above:—the stains will disappear in a few minutes, when again soak the print in clear water, to free it from the chloride of lime, and then dry it between sheets of blotting-paper. By this process I have bleached twelve prints, and letter-press belonging to an expensive book, which had been damaged by rain and sea water."—*West of England Conservative.*

Reason why Arcs of Ellipses or Circles are Pleasing to the Eye.—Professor Müller, of Berlin, has, in a late course of lectures, offered a simple and mechanical explanation of the universal admiration bestowed on these curves. The eye, he observes, is moved in its socket by six muscles, of which four are respectively employed to raise, depress, turn to the right and to the left. The other two have an action contrary to one another, and roll the eye on its axis, or from the outside downward, and inside upward. On an object being presented to the eye for inspection, the first act is that of circumvision, or going round the boundary lines, so as to bring consecutively every individual portion of the circumference upon the most delicate and sensitive portion of the retina. Now, if figures bounded by straight lines be presented for inspection, it is obvious that but two of these muscles can be called into action, and it is equally evident that in curves of a circle or ellipse, all must alternately be brought into action. The effect then is, that if only two be employed, as in rectilinear figures, those two have an undue share of labour; and by repeating the experiment frequently, as we do in childhood, the notion of tedium is instilled, and we form gradually a distaste for straight lines, and are led to prefer those curves which supply a more general and equable share of work to the muscles.

Liverpool and Manchester Railway Company.—The half-yearly meeting of the above Company was held at the Cotton Sales-room, Exchange, Liverpool, on Wednesday last; C. Lawrence, Esq., in the chair. Mr. Henry Booth, the secretary, read the report of the last half-year's proceedings, which gave great satisfaction to the Company:—

The gross receipts from the 1st July to 31st December, 1836, were	£125,279	5	9
The expenses for the same period	79,628	0	0
Leaving a net profit of	£45,651	5	9
To which add the surplus left from the preceding half-year of	1,127	15	2
Total	£46,778	0	11

From this sum the Company has declared a dividend at five per cent., payable on the 8th February, leaving a surplus of 6,378*l.* 15s. 4d. towards the next account.—*Manchester Times.*

A Foreign Grand Junction Railway,—all abroad.—Some time ago it was confidently asserted that the Pacha of Egypt had fully determined on the construction of a grand railway across the Isthmus of Suez, and England was actually visited by an agent, who contracted with iron-masters here for the supply of a considerable quantity of railway-bars, which were intended, it was said, for that destination. It now appears that the Pacha, if he ever entertained the idea, has entirely abandoned it, as he is now using the rail bar which was to have had the honour of, as it were, uniting Europe with the Oriental World, for the paltry purpose of making several short railways in the vicinity of Cairo; one of which is for the supply of his capital with stone. The canal which he was once going to dig across the Isthmus has apparently shared the same fate as the railroad.

"A. B.'s" only safety is in keeping his invention as secret as possible, and in delaying the construction of his machinery until the specification of his patent is enrolled.

Erratum.—In p. 5, of the *Mechanics' Magazine Advertisement sheet* for December, the price of Mr. Hawkins' translation of "Camus on the Teeth of Wheels," instead of 10s., should have been 10s. 6d.

The Supplement to Vol. XXV., containing Title, Table of Contents, Index, and Plate of Specimens of English Medallic Engraving by Mr. Pate, was published on the 1st of December, price 6d.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

A complete list of Patents from the earliest period (15 Car. II. 1675,) to the present time may be examined. Fee 2s. 6d.; Clients, gratis.

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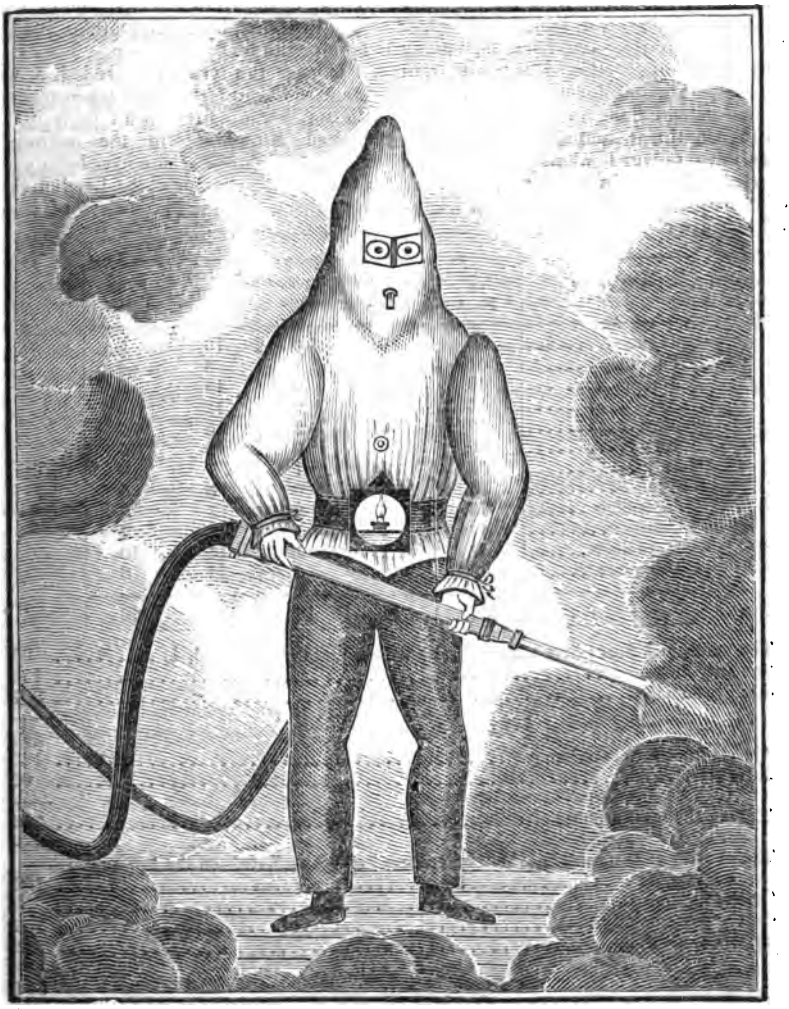
M. PAULIN'S SMOKE-PROOF DRESS FOR FIREMEN.



LONDON FIRES IN 1836.

" All full accoutr'd, well their watch they kept,
While those relieved from duty soundly slept.
With eager list they raise their watchful head,
At midnight's prime, to some loud quick-paced tread,
And soon with breathless haste, a stranger stands
Before the door, and promptest aid demands;
The engine's out, the horses soon attach'd
And off they fly, their speed with wind's well match'd.—ANON.

Sir,—" Fire and sword " have been justly reckoned among the severest scourges of mankind, and although we, in " merry England," have not for many years experienced the baneful effects of the latter visitation—yet have we, " many a time and oft," suffered severely from the devastating influence of fire. Nor have we stood alone in these calamities; on the Continent, and elsewhere abroad, fires have ravaged whole villages and created sad havoc in the towns, in many cases being attended with a most frightful sacrifice of human life.

At the beginning of the year 1836 we received intelligence of the destruction of the principal part of the city of New York, in the United States, and of Canton, in China, by conflagrations of terrific magnitude.

During the year just ended, a vast increase has unfortunately taken place in the number of fires in all parts of the United Kingdom; in the metropolis alone, 756 alarms of fire have been given at the engine-stations of the London Fire-Establishment, the particulars of which are as follows :—

MONTHS.	Number of Fires.	Fatal Fires.	Lives Lost.	Alarms from Chimneys.	False Alarms.
January	56	0	0	16	8
February	41	1	1	8	4
March	46	0	0	13	9
April	43	2	2	12	2
May	57	2	2	5	2
June	39	0	0	12	5
July	55	1	1	7	6
August	35	0	0	8	5
September	43	2	2	7	2
October	44	1	1	12	7
November	47	1	1	13	10
December	58	4	4	13	6
Total	564	14	14	126	66

The number of fires where the premises have been totally destroyed, is 33
Seriously damaged 134
Slightly damaged 397

564

Alarms from fires in chimneys 126
False alarms 66

Making the total number of calls 756

The number of instances in which insurances had been effected on the *building and contents*, is 169
On the *building* only 73
On the *contents* only 104
Neither insured 218

564

The total number of buildings damaged by fire is estimated to be 794!

In addition to the above list, the firemen have given attendance to a very great

number of fires in chimneys, in the vicinity of their respective stations; but being known to be accidents of this description, they were attended accordingly; whereas, those included in the above table were represented to be *larger fires*, and caused a general turn out of the men, &c.

The number of false alarms, by a singular coincidence, is the same as reported last year, and they have been much of the usual character. Several have been given without the slightest foundation, from motives of sheer mischief, regardless of the inconvenience to which a number of men (at all times hard enough worked) are put; or of the expenses which are thrown upon the Fire-Establishment by hoaxes of this description; to say nothing of the protection of which the public are deprived, by sending off the firemen and engines from their accustomed stations on distant useless errands. One fellow of gentlemanly exterior, who gave his name John Watts, has been in the habit of amusing himself and annoying the firemen, by playing off tricks of this sort at different engine-stations. Upon the last occasion (July 22nd,) he called at the Farringdon-street station, and stated that Messrs. Day and Martin's Blacking Manufactory in High Holborn was in flames. The engine and men from that and other stations proceeded immediately to High Holborn, but found on their arrival no fire, nor any appearance to justify the slightest apprehension of danger from any such cause. An example will be made of the first person who is found thus abusing the readiness of the firemen to afford assistance whenever and wherever required.

Atmospheric phenomena have had their share in producing groundless alarms; two of these were of a very singular character. The first occurred on Sunday, September 25th, about half-past four o'clock in the morning; when a red glare of light in the sky occasioned a general alarm of fire *eastward* to be given to the firemen all over the metropolis; no certain information being obtained as to the locality of the fire, the engines were driven at conjecture—some along Ratcliffe Highway—some down the Commercial-road—while others went to Mile End. On reaching these points, however, the first appearance became gradually fainter, and the firemen came in sight of a second light, which appeared more southerly, and which really proved to be a large fire that had just broken out at Messrs. Ewbank and Co.'s Rice Mills and Granaries, at the head of the Grand Surrey Canal Docks.

Some little delay was occasioned, by the engines being on the wrong side of the river; they were, however, got round as quickly as possible. Meantime the firemen were shipped across, and the floating-engine, which is stationed in this part of the river, was set to work, and rendered great service.

The other atmospheric phenomenon was, however, of a far more extraordinary description; the former was occasioned by the sun's rays, but the one we are now about to describe was a variety of the *Aurora Borealis*. About half-past 8 o'clock on Tuesday evening, Oct. 18, a sudden cry of "Fire" burst forth from hundreds of tongues, in consequence of a crimson glare of light appearing in the horizon; the apparent danger was north-east—and so strongly did the light resemble that of a fiercely-spreading conflagration as to deceive the oldest firemen. The alarm was greatly strengthened by what seemed to be clouds of smoke rising up after the crimson glare, and breaking and rolling away beneath it.

Thirteen engines and a large body of firemen were turned out in search of the dreadful conflagration, the existence of which no one doubted. Immense groups of people thronged the streets, and pedestrians as well as vehicles kept pouring down from the west-end of the town to see the fire.

The alarm upon this occasion was not confined to London; at Dublin,* Leyden, Utrecht, Strasburg, Troyes, Rennes, and at Nantes, the same alarm was created, attended with a similar turn-out of the firemen, military, &c. This singular phenomenon appears to have been witnessed simultaneously at these, and many other places in England, France, Germany, and Prussia, having from 47° to 54° of north latitude, and being from 1° east to 8° west of Greenwich. It was not visible at Paris. It may be in the recollection of many of your readers that a similar appearance of

* An interesting account of this phenomena as seen at Dublin, and also at Leominster, appeared in No. 5 (Third Series), of the *London and Edinburgh Philosophical Magazine*.

the *Aurora Borealis* took place in November, 1835, a notice of which appeared in my last Report of London Fires.*

The present Report exhibits an increase of 93 fires over the previous year; the number of the *consumed* and *considerably damaged* is, however, smaller in proportion to the whole amount.

Of the 33 *consumed*, 8 fires were at such a distance from the nearest station, as to preclude the possibility of any of the London engines being on the spot time enough to arrest the flames at the commencement of their career.

The first of these fires occurred at two o'clock in the morning, on the 25th of January, at the Fountain public-house, kept by Mr. Poulten, in Stable-Yard-street, Greenwich. The fire was discovered by the Police, and by their most praiseworthy exertions the lives of the inmates was almost miraculously preserved. Police-serjeant R, 1, having obtained a scaffolding-pole, which he placed in an inclined position against the window, Mr. Poulten, his wife, and son, escaped by sliding down it. The populous towns of Deptford and Greenwich are so inefficiently protected as regards fire, that the London firemen and engines are always sent for, express, whenever a fire breaks out; their attendance upon the present occasion was as prompt as circumstances would allow, and their exertions effected the preservation of the buildings on either side, although they arrived too late to prevent the total destruction of the building in which the fire originated.

The second distant fire was that in the Pig-market, Finchley, at half-past ten o'clock at night, on the 8th of February, when a slaughter-house, stable, &c. were burnt to the ground before any engine from London could reach the spot, the distance being seven miles.

On the 22d of April, soon after midnight, a terrific fire broke out in the extensive mills and granaries of Mr. Hall, at the High bridge, near Uxbridge. The reflection of the flames being seen at the west-end of the town, two of the London engines started off with post-horses, to render all possible assistance; they were, however, preceded by the engines from Uxbridge, Hillingdon, Wycomb, Staines, Bedfont, Hayes, Ealing, Windsor, &c. The mills, which were almost entirely composed of wood, burned with the greatest fury, and rendered all the efforts made to save them wholly unavailing; the fire was, however, cut off from the outbuildings. The distance from town is about fifteen miles.

May 2nd. Another fire, at Finchley, rendered the firemen's presence necessary. This fire was the work of an incendiary, and in addition to a great destruction of property, involved the death of a fellow-creature. The premises belonged to Mr. W. Parberry, and were well known as the "Queen's Head" Inn. The flames broke out soon after midnight, and about one o'clock, three of the London engines reached the spot, but the flames had gained so great an ascendancy, that the preservation of any portion of the building became impossible.

The next distant fire was that which destroyed Bellevue-house, Woodford-bridge, at three o'clock in the morning, October 18th. Although the distance from London is only eight miles, the building was totally destroyed before any intelligence of the fire reached town.

On Sunday, October 23rd, about eleven o'clock in the forenoon, a fire broke out in the premises of Mr. Pigott, cabinet-maker, George-street, Richmond, which threatened the surrounding buildings with inevitable destruction. Five engines started off with post horses the moment the expresses reached the stations, but their services were happily rendered unnecessary by the prompt and effectual arrival of a large number of excellent engines belonging to the several towns, the nobility and gentry in the vicinity, which stopped the progress of the flames, although not till Mr. Pigott's and some adjoining premises had been destroyed. The distance is eleven miles.

Soon after midnight, on Thursday, November 3rd, a fire broke out at a grocery and retail beer-shop belonging to Mr. Boswell, Fore-street, Edmonton. Immediate application was made for the London engines, and two of them were on the spot in an incredible short space of time, but too late to do more than save the adjoining buildings, which were at one period in great danger. This they succeeded in effecting. The distance, in this case, was six miles.

On the 9th of November, the "White

* Vide vol. xxiv. p. 356.

Hart" inn and posting house, at Cranford-bridge, fifteen miles from town, was destroyed by fire; one of the Fire-Establishment engines proceeded thither, but so long a time elapsed before the alarm was given in town, that the premises were totally destroyed some hours before the London firemen reached them.

In nine other cases, where *total losses* have ensued, the fires have happened in very small buildings, for the most part built of wood, and at an average distance of three miles from the nearest engine station.

Upon nine occasions, the premises on fire have been filled with such inflammable materials, and so completely ignited before the fire was discovered, as to render it quite impossible to save any portion of them from total destruction.

At two fires, one in Peter-street, Southwark, the other in Hanover-street, Rotherhithe, the houses fell down before the flames had gained any great ascendancy.

A delay in obtaining water occasioned three *total losses*, viz. one in Gibraltar-row, Lower-road, Deptford, on the 14th March; the other at Kennington-cross, on the 1st December; and the last, on the 31st December, in Ewer-street, Southwark.

One of the largest metropolitan fires occurred on Saturday, the 26th March, about ten o'clock at night, at Mr. Absalon's, No. 12, Old Bond-street. The fire broke out in a room on the second floor, from whence it spread with much rapidity; great exertions were made to cut off the communication with the Western Exchange, situated immediately in the rear of the burning premises; but owing to the difficulty in bringing the engines to bear upon the right quarter, the north corner of the Bazaar caught fire about half-past ten. The Bazaar being composed of highly combustible materials, the flames ran round it in an incredibly short space of time, and all attempts to save it became hopeless. The Bazaar communicated with the Burlington-arcade by an iron door inserted in an opening cut in the back wall; this door had been opened to facilitate the removal of goods at an early period of the fire, and in the confusion that afterwards prevailed, it was forgot to be shut. Through the opening thus unfortunately left, the flames rushed into Burlington-arcade, where they burned right and left with the utmost fury. Two engines took up a station at the end of Burlington-arcade, in Piccadilly, to check the advance of the flames in that direction; at this spot there were two plugs, but unfortunately, on two different services, and the water not turned on to either. Much delay was thus occasioned, and the ladders and hatchets had been ordered up by Mr. Braidwood, to cut off the communication; meanwhile, a masterly movement had been effected by the junction of an extraordinary quantity of hose, which was led from an engine in Bond-street, through some houses and over the roofs of others, until it was brought through one of the skylights in the roof of the arcade, from whence a most effective stream of water arrested the progress of the flames. The other two engines soon after obtained water, and the further spread of the fire was effectually prevented. The destruction of property was immense, although the fire was comparatively of short duration.

The largest fire that has happened in London for many years, was that which broke out soon after two o'clock, on the morning of August 30th last, in the premises of Mr. Wilson, tea-dealer, in Wellington-street, London-bridge.

Several of the Establishment engines, with a strong muster of firemen, were very quickly on the spot, and could a supply of water have been procured, there is no doubt that the damage would have been confined to Mr. Wilson's premises. But before water could be obtained, the flames had gained such an ascendancy, as to be altogether uncontrollable. The adjoining buildings, to which the fire soon communicated, were of great magnitude, and extremely lofty, forming a mass of flame, the heat from which was so excessive as to defy approach; added to which, the firemen laboured under a grievous deficiency of water during the whole of the time the fire was raging. The flames were, however, ultimately vanquished after a long and arduous struggle. The destruction of property was immense, not more than about one-fifth of which was insured.

It should be observed, that the awful spread of this fire was mainly attributable to the circumstance of the buildings being carried up, in gross violation of the legislative enactments made for the express purpose of circumscribing the extent of such calamities; one of the warehouses

was twice, and another one and a half times the size allowed by the Building Act!*

On the 13th of September, a meeting of a few parishioners of St. Olave's was held in the vestry of the church, "for the purpose of inquiring into the cause of the ill success of the *firemen* on the occasion of the late fire in Tooley-street." The evidence brought before the meeting was wholly *ex-parte*. The managing-director of the Southwark Water-works laboured hard to prove "that no positive deficiency of water actually occurred," and "that no delay took place in his establishment beyond the time necessary for rousing the various turncocks of the district from their beds, and for their going to St. George's church to turn on a borrowed supply from a reservoir at Brixton—turning off the branch-services," &c. &c.

The meeting endeavoured to throw all the blame upon the Fire-Brigade, that is, the servants of the Insurance-Companies, who only had one-fifth of the property destroyed lying at their risk; while the *public*, i. e. the inhabitants of the parish, who took the other four-fifths, seemed to think it a very small matter that the buildings were of *illegal dimensions—that their own fire-engine was out of repair and useless*†—or, that because the Thames was so close to the wharfs, they would have no fire-plugs laid down from the water-works!

This was the most tremendous conflagration I ever witnessed; indeed, it is said, and I believe truly, to have been the largest fire with which the metropolis has been visited since the dreadful fire at Ratcliffe in 1794, and may it be long ere we witness such another.

Of the 126 fires at which serious damage was sustained, every one presented a well-contested struggle, and it was only by the most extraordinary exertions that the flames were extinguished, and the total destruction of the premises prevented. The following list exhibits the occupation of the premises at which the foregoing fires have occurred; care having been taken to discriminate between the fires that originated in that portion of the building occupied in trade or manufacture, and those that have happened in and damaged the dwelling parts only, by placing all accidents of the latter description under the respective heads of private dwellings or lodging-houses. In the course of a few years these lists will show very accurately the comparative liability of any particular calling to accident by fire:—

Bagnios	4	Brought forward	97
Bakers	20	Coffee-shops	1
Barge-builders	1	Coffee-roasters	3
Beer-shops	5	Confectioners	2
Booksellers, Binders, and Stationers	12	Cork-cutters	2
Brewers	1	Corn-chandlers	2
Brick-makers	1	Cotton-wool, workers in	4
Brokers	1	Drapers	1
Builders	1	Dyers	2
Cabinet-makers	9	Eating-houses	6
Carpenters and workers in wood	26	Farms	3
Chandlers	1	Feather-merchants	2
Chemical Manufacturers	4	Firework-makers	1
Cheesemongers	5	Founders	6
Churches	3	Gas-works	4
Coach-makers	3	Glass-blowers	2
Carried forward	97	Carried forward	138

* By the 14th Geo. III. cap. 78, it is enacted that no stack of warehouses to be erected after the 24th day of June, 1774, shall contain more than 35 squares (each square being 100 superficial feet) of building on the ground-plan thereof, including all the external and internal walls, and so much of the party-walls, if any, as belong to such stack of warehouses, &c.

† The following colloquy took place at the meeting in question:—"Mead (the parish engineer) was next examined by the Chairman. 'I am beadle of this parish, and before I was appointed to that office I was a *fireman* for twenty-eight years. *Wilson's warehouse was all in a flame*, when I first saw the fire. My engine (the parish-engine) *was placed* at the plug in Tooley-street, opposite Fenning's wharf. The water came in *about half an hour* after the arrival of the engine. *The engine, I am sorry to say, was not in such good order as I could have wished.*

"'*Mr. Rossiter.* That I believe is pretty generally the case with parish-engines?

"'*Mead.* Yes, very few parish-engines are kept in working order.'"

Brought forward.....	138
Grocers.....	4
Haberdashers, &c.	5
Hair-dressers, Horse	2
Hat-makers.....	12
Hemp and Flax-merchants.....	1
Hotels	2
India-rubber-merchants	1
Japanners	2
Lodging-houses.....	35
Lamp-black-makers.....	5
Lucifer-match-makers.....	3
Marine-stores, dealers in.....	2
Millers	2
Musical-instrument-makers	1
Mustard-manufacturers	1
Oil and Colourmen	5
Painted Baize-makers	1
Printers, Letter-press	1
Printers, Copper-plate.....	1
Private Dwellings	211
Public Buildings	4
Rag-merchants	1
Rope-makers	1
Carried forward.....	442

Brought forward.....	442
Saw-mills	1
Ships	2
Steam-vessels.....	1
Shops, Offices, &c.	23
Silk-weavers	1
Soot, dealer in	1
Stables	12
Steam-engines	1
Straw-bonnet-maker	2
Tailors	8
Tallow-chandlers, melters, &c.....	5
Tinmen, Braziers, and Smiths	5
Timber-merchants	1
Theatres	1
Unoccupied Houses	1
Under repair, do.	9
Varnish-makers	2
Victuallers, Licensed	36
Upholsterers.....	1
Warehouses	3
Wine and Spirit Merchants.....	4
Workhouses	3
Total	564

The daily distribution of the fires this year has been as follows:—

Monday.	Tuesday.	Wednesday.	Thursday.	Friday.	Saturday.	Sunday.
76	76	87	80	91	74	80

The following table shows the distribution throughout the twenty-four hours:—

	First Hour.	Second Hour.	Third Hour.	Fourth Hour.	Fifth Hour.	Sixth Hour.	Seventh Hour.	Eighth Hour.	Ninth Hour.	Tenth Hour.	Eleventh Hour.	Twelfth Hour.
A.M.	32	24	18	16	12	12	12	16	5	13	17	17
P.M.	20	11	16	17	22	42	22	46	37	58	36	46

The customary diligence has been exercised in every case to ascertain, if possible, the causes of these fires. Notwithstanding the difficulty naturally belonging to this investigation, and the impediments frequently thrown in the way of inquiry, the causes have, in the greater number of instances, been satisfactorily ascertained, and the result is as follows:—

Accidents of various kinds, ascertained to be for the most part unavoidable . .	11
Apparel taking fire on the person	7
Bed-curtains set on fire	71
Candles, various accidents with	51
Carelessness, palpable instances of	18
Charcoal fires (portable)	2
Children playing with fire	6
Fires, kindled on hearths	5
Flues and chimneys, defective, or ignited	72
Fumigation, negligent	5
Furnaces, overheated, &c.	9
Gas, sundry accidents with—for the most part occurring with gas-fitters during the progress of repairs	38
Gunpowder	1
Carried up.....	296

Brought forward	296
Heating of hay	1
Ditto of lime	3
Ditto of rags	2
Ditto of soot	1
Lamps, sparks from	2
Linen incautiously hung before fires, &c.	31
Ovens, overheated	6
Shavings, loose ignited	13
Sparks from fire	7
Stoves and stove-pipes, defective setting or overheating, &c.	28
Trade and manufactures, application of fire-heat to various purposes of, &c.	34
Tobacco smoking	1
Unknown	96
Wilful	8
Window-curtains set fire to	35
	564

I have the mournful task of recording no less than fourteen fatal fires during the past year, each attended with the loss of one human life. The number of lives lost is the same as last year, although the accidents have been twice as many. In eight of these cases, the wearing-apparel of females took fire, and before it could be extinguished they received such serious injuries as to occasion death. It is exceedingly to be regretted that, in many instances, the unfortunate sufferers ran screaming about, thereby increasing the vehemence of the flames. Had they thrown themselves on the floor and rolled over and over, the fire would have been materially checked, if not entirely extinguished. I offered some remarks upon this subject in my last Report of London Fires (vol. xxiv. p. 362), which it would be well to keep constantly in mind.* Heads of families should make a point of frequently explaining the nature of these accidents, and inculcating the simple facts necessary to be borne in mind. The lamentable consequences of a want of information respecting the best method of proceeding in case of accident, are truly awful. The number of lives thus lost in the course of the past year is most astounding; the number that have come to the firemen's notice, and are therefore included in the present Report, is but a very small portion of the number of persons who have perished by this, the most dreadful of all deaths. Of the remaining six fatal fires, the first was on the 23d of April, when a fire broke out about a quarter before five o'clock in the morning in the house of Mr. Freeman, No. 5, Fenchurch-buildings, and Mr. William Symes, an elderly gentleman, perished in the flames. The other inmates of the house were extricated with some difficulty; the preservation of their lives being entirely owing to the courageous and active exertions of Mr. Brewer, Mr. Blanchford, and some other neighbours. The next fatal fire was that at the Queen's Head Inn, Finchley, on the 2d of May, when the ostler, who slept over the stables, was burnt to death, before any effort could be made to effect his rescue. This fire was the work of some diabolical incendiary, who, to gratify his vile propensity, not only involved the destruction of much valuable property, but also inflicted the most horrible of deaths upon a poor, inoffensive fellow-creature.

On the 12th of September, about three o'clock in the morning, a fire broke out at the "Duke of Kent" public-house, Peter-street, Southwark-bridge-road. Mrs. King, wife of the landlord, stopped in the bed-room wrapping some clothes round her infant child to protect it, until the flames gained such an ascendancy that retreat was impossible. In this situation, with the room filled almost to suffocation with smoke, and the flames advancing rapidly towards her, she dropped the child out of the window, and imme-

* The following pertinent remarks appeared in the 4th volume of "Retrospect Discoveries," p. 294:—

"To check the progress of the flames, a green-baize cloth might be laid upon the tables or other pieces of furniture in rooms where any danger from fires is to be apprehended. If this cloth were known in the family by the name of the *Stifling-Cloth*, it would probably be as readily used when there was occasion for it, as fire-engines or buckets are now. A cloth coat or a blanket will answer the same purpose. It should be explained to females and children, that as flame always flies upwards, if they continue in an upright position the fire has a greater power, and the neck and head run a great chance of being hurt."

diately afterwards precipitated herself to the ground. The infant escaped with little injury, but the mother was literally shaken to pieces, and she expired the following day at Guy's Hospital.

The next calamity took place in Shoemaker-row, Blackfriars, on the 28th of November, when Mrs. Berganie was burned to death. The origin of the fire, which broke out soon after three o'clock in the morning, could never, with any degree of certainty, be ascertained. It is supposed the unfortunate sufferer had fallen asleep and ignited her clothes; be this as it may, when the fire was first discovered it had spread to such an extent as to render it impossible to enter the lower part of the premises, at the back of which Mrs. Berganie was afterwards found —a melancholy spectacle.

On the 5th of December, soon after eight o'clock in the evening, the house of Mr. Hancock, 47, Clifton-street, Finsbury, was wilfully set on fire on two different floors, by igniting two beds, on one of which an infant daughter of Mr. Hancock, only ten months old, was at the time sleeping. The fire was discovered time enough to be extinguished without much difficulty, but not until the little sufferer had received such severe injuries as to destroy its tender frame. The inhuman monsters who committed this crime, have for the present evaded justice; but go where they will, they must be for ever haunted by an accusing conscience, and live wretched victims to the worm that never dies—to the fire that is not quenched.

The last fatal fire occurred on the 26th of December, at the house of Mr. Tollfree, Blackman-street, Borough. Mr. Tollfree and his family made their escape by jumping down a short distance from a back window; Mr. T. directed his female servant to do the same, but paralyzed by fear, she appears to have been unable to make this small effort for her own preservation; she remained behind, and perished in the flames.

It is to be regretted, that of the several fires known to have been wilfully occasioned, the authors have, one and all, for the present escaped detection. The most patient and diligent inquiries, and the most minute investigations, have in several instances taken place. This was particularly the case after the fatal fires at Finchley, and in Clifton-street; but the evidence adduced was not of that clear and decisive character to satisfy the ends of justice, and the guilty parties have for a season escaped.

At the commencement of this paper, I alluded to the unusual prevalence of fires during the last twelve or fifteen months, in various parts of the globe; and certainly, at no other period within my recollection have so many splendid buildings—such an immense amount of property—or so large a number of lives, been destroyed by fire.

The destruction of property has, in many instances, been principally—in some cases wholly—attributable to the absence of suitable means for checking the progress of incipient conflagrations. These deficiencies, however, having been frequently severely felt, are, in many places, in course of correction, by providing engines, and the accompaniments necessary for opposing the spread of fires.

I have already noticed the unprotected state of some densely populated districts, and we not unfrequently see large fires, even in the very heart of the metropolis, unattended by any firemen or engines, except those belonging to the insurance companies. At the memorable fire of London in 1666, and for half a century afterwards, the means of extinguishing fires were very imperfect, consisting merely of buckets, hand-squirts, and squirting-engines; the providing and working of which, was made compulsory upon the several *parishes*, the *aldermen*, and the different *companies*. Upon the formation of fire-insurance companies, at the close of the seventeenth and beginning of the eighteenth centuries, the provisions then existing for the suppression of fires were so inadequate for the purpose, that the insurance offices deemed it expedient to maintain a fire-engine* and a body of firemen, to protect the property which became placed at their risk.

In the course of time, from the circumstance of the several parishes exhibiting a great want of energy, and manifesting a disinclination to bear the expense necessary for making their fire-engines effective, they became every year less useful, and the suppression of fires eventually devolved almost wholly upon the servants of the insurance companies;

* Newsham's engine had just then been introduced.—Vide *Engineers' and Mechanics' Cyclopedia*, art. Fire-engines.

whose engines, being always of the very best description, and the firemen from constant experience being exceedingly expert in their application, they began to assume a character of considerable importance in the metropolis.

The strength of this force, upon which the protection of the inhabitants of London from fire has now for many years mainly depended, was subject to great fluctuations; some of the offices giving up *fire* insurance, new ones springing up from time to time, and the older ones changing their stations and reducing their establishments as they thought fit.

Each office acted for itself, independently of every other, and the firemen did the same when they met at fires. The ill effects of this mode of acting was evident to all attentive observers, and the superior advantages of harmonious co-operation was loudly and incessantly asserted in the public prints. The insurance companies were satisfied of the great superiority of united efforts, but many difficulties stood in the way of this desirable arrangement. The matter was taken up, however, by the Sun and some other fire-offices in 1832 with much spirit, and the result was the formation of the present general fire-establishment. Whatever advantages might have been anticipated from this measure, the experience of the past four years proves that they have all been fully realised. The advantages of such an establishment to the insurance companies, and to the country at large, is immense; at the same time, the existence of such a powerful and effective force, compelled by no fiscal regulation, responsible to no public body, and authorised by no legal sanction, in this the first metropolis in the world, is a singular instance of the effect of commercial enterprise, and presents a case to which, I believe, there is no parallel. Although the policy of permitting the organization and maintenance of such a force can never for a moment be questioned, the *existence of the necessity for its formation* reflects infinite disgrace upon the public generally (whose apathy towards these matters is proverbial), as well as upon the domestic government of the country.

The servants of the insurance companies have always used, and ever must use, their own discretion, as to whether they will give their attendance at any particular fire, or not. Instances of their refusal have occurred, and they cannot be compelled to attend, or to give any reason or explanation to the public for refusing; they are amenable only to their employers, who are responsible to no one. Fortunately, however, for the public safety, the insurance companies are as willing, as they are able, to render every assistance in case of accident; and it is important that all persons, and especially the residents in the towns and villages within twelve miles of London, should know, that in any emergency from fire, the London Fire Establishment, as now constituted, is not only ready, but even anxious to afford the assistance of its powerful engines and experienced firemen, to any extent which the nature of the danger may require. Nay, further, a messenger arriving at the stations, with information of the outbreak of an alarming fire, within the above distance round London, would be liberally rewarded, provided he gave the alarm in sufficient time, to enable the engine to arrive, so as to be of real service in checking the spread of the conflagration. As much as half a guinea is frequently paid by Mr. Braidwood, for an early call a large and dangerous fire, under such circumstances. The application would receive immediate attention, if made at any of the engine stations in the metropolis, but it is preferable that the call should be carried forward to the principal station in Watling-street, City. The engines, when so called, always carry an extra supply of leather hose, and travel with four post horses at their utmost speed, and not a moment's time is suffered to be lost. Relays of horses, sent out to meet the engines on such occasions, afford a most valuable aid. This notice of the readiness of the Establishment to forward its men and engines appears necessary, as some instances have occurred of large fires within a few miles of the metropolis, of which no information was given till too late to be of any real service. Thus, for instance, upon the occasion of the recent fire at Belle-vue House, Woodford-bridge, no intelligence reached the fire-offices till late in the afternoon, when the building had been some hours a ruin, and the fire had subsided from the complete exhaustion of all combustible materials.

The establishment of one uniform body of firemen, guided by intelligent officers,

under one master mind, has enabled the fire-offices to avail themselves to the utmost extent of the suggestions of practical men, for improving their present machinery, or of introducing any thing new that possesses superior advantages. During the past year a great number of minor improvements have been made in the accoutrements and discipline of the men, with a view of rendering them pre-eminently efficient, both in the preservation of life, and the protection of property. Additional sets of scaling-ladders of improved construction have been provided, and the men have been frequently exercised in raising and joining them; in which some have become exceedingly expert. I have seen some crack hands at the head station in Watling-street, join and raise seven lengths, forming a ladder upwards of forty feet high, in *twenty seconds!* These ladders with the improvements made by Mr. Merryweather, engineer, of Long-acre, form the simplest and best external fire-escape yet known," and have been extensively adopted by several of the principal metropolitan parishes. Sheets of canvass, with leaden weights to steady them, have been carried by the engines to cover the gratings of drains, to prevent the escape and waste of water. The senior firemen have been armed with short axes, having a cutting and a ripping end, which are worn in leather sheaths affixed to the belt; the junior firemen carry a canvass bucket strapped on their back During the year, my long despised *portable-dams* have been in constant and successful employment; thereby enabling the firemen to get the engines into full work, the instant water is obtained.

At the beginning of last year, at my earnest request, Mr. Braidwood provided his engine in Watling-street with a pair of moderate sized lamps, furnished with strong reflectors, in lieu of links which had previously been employed. These lamps have one tongue at the side and another at the back, so as to fix upon the engine and throw a light forward while travelling, or backward while the engine is at work; or they can be hitched on to a fireman's belt, throwing a distinct light before him wherever he goes, while, at the same time, both his hands are left at liberty to do whatever is required. It has been a practice from time immemorial, to use *links* at fires, but they are exceedingly objectionable; they occupy one of the fireman's hands, soil the engines and clothes of the firemen and others, and are continually dropping fire about wherever they are carried. The new lamps first came into use at a large fire in Trinity-yard, Leather-lane, on the 3d of February, and were at once found to be so useful, that all the Establishment engines were immediately supplied with them. The greatest novelty, however, is the introduction of the smoke-proof dress, of Lieut.-Colonel Paulin, commanding the corps of Sapeurs Pompiers, in Paris. M. Paulin, having fully established the efficacy of this dress by actual experiment, it was submitted to the committee of managers of the London Fire Establishment, when Mr. Braidwood tested it with the same successful results as M. Paulin obtained; all of which was done, by-the-bye, eight years ago by our countryman DEAN.

The accompanying drawing (see front page,) represents a fireman equipped with M. Paulin's dress, which is made of leather, and is a kind of hood which reaches down about the middle, being there fastened to by a belt. The wrists are secured by strings. Two glass eye-pieces afford uninterrupted vision to the fireman. A small leather hose is attached to the back of the dress, through which a supply of fresh air is continually forced by the working of an engine, or what is better (as in Mr. Dean's apparatus), by a pair of small bellows. The air thus thrown into the dress is always escaping in small quantities through any crevices that may occur at the middle or at the wrists, thereby preventing the entrance of smoke at any of those places. A lamp is attached to the belt, to which air can be supplied from the dress, when the atmosphere in which the fireman is compelled to operate, is so vitiated as to be unable to support combustion. A whistle is affixed just opposite the mouth, by which the wearer can give any preconcerted signals. The first employment of this dress "on actual service," took place at a fire in Basing-lane, on the 22d December, as mentioned in your "Notes and Notices" at page 272, which was the first opportunity that presented itself,

after the experimental trial in August last, when the positive efficacy of the apparatus was satisfactorily established.

The opportunities of applying this dress with advantage, are not, perhaps, so numerous as many persons imagine; but whenever the circumstances occur to which it is adapted, the advantage of its employment are immense. In all cases of fire in vaults or cellars, or in confined places where sulphur and various other pernicious substances are deposited, or in the holds of ships, &c. this dress is invaluable.

Having for fourteen years attentively watched the progress of the firemen, under the old state of things—and for four years the results of the united system, I have no hesitation in most positively asserting, that both the Insurance companies and the public generally are gainers by the change. Perhaps, among the numerous points of difference which distinguish the two systems, the most marked is the mode of treating fires generally; under the "*old system*," the firemen were as prompt in their attendance as their imperfect arrangements would admit, but on arriving at a fire they began to make the most diligent inquiries about *insured* or *not insured*, and on discovering any property in which their own particular office was interested, they did their utmost to extricate it as much as possible from the flames —this done, their attention was given to their engine, the fire in the mean time raging with almost uncontrolled fury. To this practice alone, we are indebted for the spread of many a fire, which by ordinary attention might have been stopped at a very early period of its career: this circumstance had much, very much to do, with the extent of the lamentable fire at New York in December 1835.

The firemen of the present day, in this metropolis, make no attempt to extricate property, but apply themselves immediately, with all their skill and energy, to the suppression of the fire; by which means they most effectually save a large amount of property, which, under any other mode of proceeding, would be destroyed, in eight cases out of ten extinguishing the fire *in the apartment* in which it begins. As soon as the fire is safely put out—*but not till then*—inquiry is made to know if the property damaged is insured or not, for the purpose of apprising any parties who may be interested therein. By this proper course, the *uninsured*, the *insured*, as well as the *insurers*, all equally receive the greatest possible protection. The advantages, arising from this cause, are increased by the particular mode of dealing with fires introduced by Mr. Braidwood, viz. fighting them at close quarters; aided by the opportunities of doing so, from extraordinary promptness in arrival and getting to work, afforded by the arrangements of the fire-engine establishment.

The firemen, *now*, never depend upon gratuitous aid at fires; all persons who volunteer their services to work the engines, are paid for their labour at a fair rate, besides being furnished with a proper quantity of refreshments. The *military* and *police* when thus engaged, are remunerated like strangers. By this satisfactory arrangement, the engines are always well manned and worked with the greatest spirit, enabling the firemen to devote their undivided attention to the skilful application of the excellent jets of water thus placed at their command.

A floating fire-engine of great power is in course of completion, capable of being worked by one hundred and fifty men, though ninety is the regular complement. It will be stationed as near Southwark bridge as possible, and some very judicious regulations have been made to ensure a prompt and effectual method of bringing this valuable auxiliary into action, wherever its powerful aid can be employed.

From the statement made at the commencement of this report, it appears that in five hundred and thirty-one instances, out of five hundred and sixty-four, the fire has been fairly beaten by Mr. Braidwood and his brave corps, even in the very building where it first began. This has been no easy task, nor has it been attended with any ordinary kind or degree of danger; nevertheless, it is with unfeigned pleasure I state, that no serious accident has happened to any of the firemen in the execution of their duty. Numberless contusions, and so forth, many of them inflicting much suffering, have unavoidably been encountered; but no loss of "life or limb" has this year to be recorded.

I have been an eye-witness to the bravery, the skill, and the patience of the

firemen, under circumstances that appeared almost to defy a successful result to their intrepidity, though ultimately crowned with victory. To see this, I have, to a considerable extent, shared their dangers. Few, besides myself, disinterested as I am, have seen them; and, therefore, as one of the few, I now inform the many.

The civility and politeness of the present firemen, and their readiness to give every information to strangers, is one beauty of their system with which the many must be well acquainted.

Wishing Mr. Braidwood and his assistants health, happiness, and prosperity, in the discharge of their heroic and charitable offices,

I remain, dear Sir,

Very truly yours,

WM. BADDELEY

London, Jan. 26, 1837.

THE INCENDIARY.

A Portrait.

By the Author of the "*Mechanic's Saturday Night.*"

The door was clos'd, but, like a scanty form,
Shrunken with age, its dry and parch'd proportions
Scarcely its frame-work fill'd; adown one edge
A narrow line of light did pierce its way,
No broader than one snowy thread of silk.
I linger'd near the door—I know not why;
A cold, unearthly trembling shook my limbs,
And something, superhuman, drew my eye
To the small stream of light; there I beheld
A gaunt pale form. He, all suspiciously,
Though quiet and alone, his fearful looks
Cast round, as if he thought the sightless air
Did watch his deeds. Round and about him lay
Cramm'd in each crevice of the silent room,
The black materials of his murd'rous work.
To apply the fire he more than once attempted,
But staggering wild, incapable he seemed,
As if some hidden spirit held his hand,
And check'd the murky purpose of his soul.
Now, cautiously, again he glared around
(The match still mould'ring in his trembling hands,)
Like one who had imbibed a project vast,
And too gigantic for his tremulous mind,
Then suddenly he ey'd his match minutely,
And stood as if he listen'd to some small
Shrill cry, arising from his dark soul's depth.
A sudden stride he made; the sullen flesh
Of his white cheeks collaps'd, and on their bones
It lay, all-harden'd like to marble cold.
Oh! he did look indeed a fearful thing!
Strange shadows flitted o'er his brow, which seem'd
Of human kind, enough to feel his crime,
Yet not enough to stay its foul resolve.
At length he glided with uneven gait——
Quick, zig-zag, and unsteady was his pace;
Another glance around he gave, then softly,
Yet keenly watchful, the slow fire applied
To his infernal mixture. Coweringly
He gaz'd upon the clinging element,
And when he saw it creeping on its red
And sulphurous track, with sure, unerring hold,
Descending quietly, he slunk away!

From the Monthly Repository, for November, 1836.

A FEW WORDS TO MR. MACKINTOSH AND NAUTILUS.

Sir,—I stated at the conclusion of my last letter (No. 697), that I had not then made up my mind whether I should answer Mr. Mackintosh's letter (No. 698). In that communication, his method of accounting for the moon always presenting the same face to that of the earth, seemed to me so repugnant to every known law of nature, that I could hardly imagine that he was in earnest. But, from his reply to Nautilus (No. 701), it appears that he was perfectly serious; and, strange to say, he seems to infer from my silence, that I must be a convert to this part of his theory. He states, "I was not ignorant of this when I made the assertion, that the moon does not revolve upon her axis, nor do I see any necessity to withdraw or qualify that assertion from what has been advanced by Nautilus. Kinclaven also objected to the same assertion, but the parallel case of the wheels, and leaden balls, at once enabled him to perceive that it had not been made unadvisedly," &c. Indeed, Mr. Mackintosh, you very much deceive yourself if you imagine, that because I did not reply to *this*, I have become a convert to that strange part of your electrical theory. Although some such notions as you have promulgated, about the leaden balls and fly-wheel, you may have seen represented in some orreries, surely you cannot be indebted to these artificial toys in attempting to upset what in reality takes place in the laws of nature. I shall make another slight attempt to reclaim you, Mr. Mackintosh, although I am much afraid you are past redemption.

If a body is perfectly spherical and of uniform density, and if it were projected forward, there could be no reason assigned why it should revolve upon one axis more than another; or, indeed, why it should revolve round any axis. But if this is not the case, it is well known (or ought to be known), and can be demonstrated from a combination of mechanical and mathematical principles, that it must revolve round an axis. A stone thrown from the hand always revolves round its axis; a cannon-ball, or bomb-shell, has often such a rapid motion of rotation as to derange its intended line of direction. Now, the earth and moon, and all the other planets belonging to the solar system, are in figure, oblate spheroids; and it has been demonstrated from facts deduced from physical and mathematical principles, by Sir I. Newton (be it remembered, however, that Mr. Mackintosh holds Newton's demonstrations at a discount of 99+ per cent. since he invented his electrical theory!), but more fully by M'Laurin and Boscovich, and by hundreds of others, that bodies of such figures when in motion must revolve round their axes; and the greater the ratio of the equatorial diameter has to the revolving axis, so much quicker will the body revolve round its axis. Thus, of all the planets belonging to our system, the ratio of the equatorial diameter of Jupiter to its revolving axis is the greatest, being in the ratio of 14 to 13 nearly; and Jupiter revolves round his axis in a shorter time than any other of the planets, the time being only 9 hours and 56 minutes.

Mr. Mackintosh has sometimes put other puzzling questions to me. He wishes me to give a demonstration of what produced the first impulse, &c. I must inform Mr. Mackintosh that this proposition is far beyond the "ken" and "scan" of my humble attainments. But if he will propose the question to his own pastor, and if he should happen to be of the orthodox way of thinking, there is no doubt but he will give him a true solution of it.

I shall take this opportunity of making a few remarks on the letter of your astronomical correspondent, Nautilus.—(See No. 697, p. 222.)

Nautilus states, "that he was rather surprised to read the elaborate refutation which Kinclaven, at p. 148, thought it necessary to give of O. N.'s most absurd conclusion, about the latitude of London and the pole star, &c."

Upon turning to p. 148, I find that my whole letter, which contains this elaborate refutation, only takes up three-fourths of a single page; and the portion of it which I take in refuting O. N.'s article, takes up no less a space than eighteen lines! But Nautilus himself (notwithstanding my elaborate refutation) has given another refutation of the same article, still more elaborate, for he takes up no less than nineteen lines. I am almost wicked enough to suppose, that Nautilus had made the above remark after trying the experiment with the bottle of crusted port,

but that before proceeding; he found it would be necessary to discuss the contents of the bottle. Again, adds Nautilus, "Kinclaven himself may be caught napping now and then; for instance, what does he mean by talking of the pole star's distance from the tropic of Cancer, &c. There is, certainly, an error here; "the tropic of," I should imagine, is a press error. But if Nautilus will again read over the elaborate article, he will find that in making use of these terms, I was only quoting O. N 's statement, which he in his turn copied from Leadbetter's Astronomy. Well, Nautilus, to please you, I agree with you it is rather an improper expression—it ought to have been—" the difference of longitude between the pole star, and the first scruple of Cancer."

I am, Mr. Editor, yours, &c.

KINCLAVEN.

SAFETY POWDER MAGAZINE—LIGHTING CONDUCTORS.

Sir,—In the year 1810, having witnessed the explosion of a powder magazine near Naples, and examined the effects upon surrounding objects, I bethought me of constructing one upon a principle that would obviate, or confine, as much as possible, the danger consequent to ignition. I communicated my plan to General Colletta, then Inspector General of Artillery, who so highly approved of it, as to order one on a small scale, to be constructed under my inspection. A circular pit was sunk twenty-five feet deep, and forty in diameter. The bottom and sides, after being lined with stiff clay, were built up with the best Puzzolana mortar and stone (or brick), and then coated with waterproof cement. The size of the cylindrical chamber, when finished, was twenty feet deep, and as many in diameter. Being protected from the rain, and allowed sufficient time to dry, a wood fire was kept up at the bottom, for several days, till the coating at last was perfectly dry to a considerable depth. A mixture of oil and lime was then plentifully applied, so as to fill up every little crack, and saturate the plaister and wall.

The superstructure for the door and roof above the surface of the ground, was made as slight as possible, as was also the roof. The object I had in view in this construction was, to confine the effects of an explosion to a vertical rise in the air; much more so, even, than in the springing of a mine; and, moreover, a part of my plan is, to give the pit, if the locality require it, an inclination from the perpendicular, of several degrees, so as to *direct* the possible explosion *towards* the point where the least damage would accrue. There are many ways of rendering such a magazine perfectly dry and water-tight, all too obvious for me to describe. As a means of abstracting from the confined air, a great portion of the water held in solution, I constructed several copper cylinders, drilled full of holes, which, being filled with lumps of fresh and well calcined lime, and suspended from several points of the roof at various altitudes, absorbed the moisture, if any existed. However well made, gunpowder is not near so deliquescent as is generally supposed; it only becomes so when made with impure nitre, and too large a portion of charcoal.

A magazine of only the above dimensions will contain conveniently, above one thousand barrels of gunpowder; and any number of such constructions may be clustered into one common enclosure in any eligible situation. I am decidedly in favour of lightning conductors, for the preservation of every kind of buildings and ships from the injurious effects of electric discharges. I have seen abundant instances of their saving qualities. But the most secure way of applying them in such a case as the present, is to have them isolated near, but not upon, the magazines. For such conductors to be of sure avail, they must be of a competent diameter, a mass of metal: those generally used are not a quarter big enough. The smallest part should be an inch diameter; and be it borne in mind, *that a tube has twice the conducting power of a solid bar*. Copper or zinc is far better than iron, in as much as they are less liable to oxydation. The upper extremities should be strongly gilt, or rather plated with gold or platinum. I say "extremities," because it is very advantageous for it to terminate in *several* branching points. If to preserve a metallic conductor from rust, it be coated with paint, or pitch, or tar, its saving qualities are not merely impaired, but it invites the danger it was meant to parry. The electric discharge

is drawn to the gilded or copper extremity; but, instead of being conducted down the bar, it flies off at tangents before reaching the ground. It is only the *surfaces* of bodies that can accumulate, restrain, or conduct an adventitious mass of electric fluid. The state of the surface of a conductor, therefore, is of great importance, and consequently the advantage of a tube.

The base of each conductor should be inserted in the ground, at least ten feet, unless water be found at a less depth. The height should be at least forty feet. A scaffold pole is a good support to it; and the latter should be furnished with bracket steps, in order that the rod may be now and then scrubbed with a piece of sandstone.

The far greater number of accidents occurring from the explosion of masses of gunpowder, have been traced to the defective construction of the barrels, which has caused the powder to be scattered about, and so exposed to numerous contingencies, especially of collision. The remedy to this evil is in the hands of every cooper. Moreover, powder barrels should be well pitched or coal-tarred inside and out, which would defy the damp, or even the water of a well. So much for the present, on powder magazines.

I am, Sir,
F. MACERONE.

MINERS' MIRROR, OR GUIDE IN FORMING STRAIGHT DRIFTS.

(From the *Transactions of the Society of Arts.*)

(The Society voted to Mr. Joseph Gretton, of Timberfield, near Chesterfield, the Silver Medal, for this invention.)

Mr. Gretton states, that having occasion to make a drift in a colliery, he was obliged to have the iron tramroad taken up, in order to avoid the local attraction which otherwise would have been exerted on the needle of the compass employed in that operation. This inconvenience induced him to try if he could not find some other guide in forming a straight drift, either level or inclined; and the result was the invention of the instrument sent by him to the society.

The miners' mirror consists of a cast iron circular plate 5¼ inches diameter, and ¼ of an inch thick; on one side of which, and in the middle of the plate, is a semi-globular projection, the diameter of which is 1½ inches. On the other side of the plate, and concentric with it, rises a projection which is one inch from the edge of the plate, in the form of a hoop, one inch high, a quarter of an inch thick at the base, and a little more than one-sixteenth of an inch thick at the edge (this leaves the sides of the hoop sufficiently sloping to allow of its being taken out of the sand with facility when moulded at the iron-founder's). In the inside of this hoop, which is three inches diameter, a mirror is fixed by placing a small quantity of glazier's putty all round the hoop, in the angle at the bottom, and pressing down the mirror firmly upon it. The mirror is then to be attached to one end of a piece of board, about 14 inches long, 5 inches broad, and 1¼ inches thick, by means of four screws passing through four holes drilled through the plate, within half an inch of its edge, and at equal distances from each other. The semi-globular projection at the back of the plate keeping it at a small distance from the board, allows of the adjustment of the mirror by means of the screws. A tin cover may be fitted on the hoop for the protection of the mirror; but the projection of the hoop only will generally be found a sufficient protection against accidents. This instrument may be manufactured for about 1s. 6d.

This mirror is intended to guide the workman when he is driving levels, headings, or drifts, in coal seams; or levels or drifts in any other strata, when the drifts are required to be driven in a straight line, and in a particular direction, as horizontal or inclining, and, at the same time, towards a particular point of the compass.

Suppose it to be required to drive a heading in the coal, from one coal-pit to another, at a considerable distance; first, let five or six yards be driven in the required direction, as near as may be, without the mirror, then place a dial (miners' compass) at the extremity driven, with its sights in the direction of the two pits (before ascertained on the surface of the ground); then insert the board of the mirror into the solid coal on the side of the drift, near the bottom of the pit; and wedge it fast, in such a situation as that the mirror may be in the line of the sights of the dial; then adjust the mirror, by means of the screws, so as to reflect the light of a candle in the line of the sights of the dial. Then the driving of the heading may be proceeded with, and the workman may, at any time, know if he has proceeded in the right direction, by merely holding the candle by which he works between his eye and the mirror; and if he can see its reflected image in the mirror, of course he has proceeded right; if not, he must know he has proceeded wrong. When the workman gets a considerable distance from the mirror, say fifty or sixty yards, it should be removed nearer to him,

and fixed as before, as the image of the candle is not so distinctly observed at that distance. In this manner, drifts may be driven to any length in the required direction, by ordinary workmen.

The mirror may be made to reflect the image of the candle accurately horizontally, by adjusting the mirror to reflect the image of the candle so as to correspond with the sight of a spirit level: thus it may be useful in driving dry levels under ground; for, in this case, the reflected image of the candle should always be at the same height above the floor of the level as the mirror is.

The mirror may also be adjusted so as to reflect the image of the candle to any angle of elevation required, by making it reflect the light, so as to correspond with the sight of a spirit level, having a graduated arc, and fixed to the proper degree of elevation; thus, the mirror may be useful in the driving of inclining drifts.

The miners' mirror recommends itself, on account of its simplicity, and the ease and accuracy with which the miner may, at any moment, examine his work.

MISCELLANEOUS NOTICES--CHURCH BELLS, COSMOLITES, ACOUSTICS, ETC.

Sir,—In No. 702 of your miscellany, Mr. W. Baddeley informs me that the idea of bringing the clapper or hammer to church bells, instead of swinging the huge bells roundabout to the clappers, is not new. I am glad to hear it, and only wonder that there ever could have been any other. I am sorry, however, that he does not inform us where we may see any such arrangement in actual practice.

In No. 696, "A Constant Reader" inquires where the numerous aerolites, or cosmolithes, are to be found, which I speak of in No. 689, as having fallen in Kent. I should have made an earlier reply to this inquiry, had I been sooner able to find the note-book in which I have it recorded. It is in the parish of Lymenge, near Sandgate and Hythe, near the parsonage-house of the Rev. Mr. Price. I have not been on the spot myself, but have seen a parcel of the cosmolites, about the size of an egg, picked up there by my friend, Mr. Charles Herring, of the Regent's-park. Their composition is similar to the generality of such formations, that is, iron, with a little nickel and alumine.

If your correspondent "Evander," who, in No. 701, inquires the cause of such a quantity of steam or aqueous vapour settling on the windows of a room in which gas is burnt, will do me the honour to peruse my paper (No. 2) on the Electrical Theory of the Universe, he will find that I suppose such gas to consist of an electric or galvanic globule, inclosed in a vesicule of water. This water is set free upon the combustion of the gas, and may account for the deposit he describes.

All the expedients for warming rooms by the *admission* of air, heated either by gas or any other fuel, are noxious. Such heated air should be confined in flues, which, having in the aggregate a large surface, warm the air that is in contact with them. I have seen a room heated by a powerful stove, which *dried* the air so much as to make it necessary to place a vessel of water, the evaporation of which restored the necessary humidity.

I have been much gratified by the perusal of Mr. T. Pine's paper, "*On the Progress of Vegetation under the Influence of Vapours,*" in No. 701. If he also will do me the honour to look at my paper above mentioned, he will see that the phenomena he describes, of the speedy absorption of the electricity contained in vapour by the leaves and points of plants, and the consequent deposition on their surface of the water which contained that electricity *or caloric,* tallies entirely with my idea of the formation of such vapour, and the identity of the caloric, electric, galvanic, magnetic fluids, the light of the sun, and all other known matter.

The acoustic chair, and the observations of Mr. Curtis on the transmission of sound, in No. 701, are very interesting. Perhaps most people are not aware of the very extraordinary increase of the power of hearing that may be obtained, by merely placing the hands behind each ear, and pressing them forward so as greatly to increase the collecting surface. Upon this principle, in 1813, I constructed a pair of pasteboard ears for my friend, Monsignor Aquaviva, at Naples; who, being a bishop, but passionately fond

of music, and somewhat hard of hearing, was enabled to attend the opera, and hear better than any body else, without exhibiting himself in the front of the boxes.*

Yours, &c. F. MACERONE.

REPORT OF THE COMMITTEE OF THE FRANKLIN INSTITUTE OF THE STATE OF PENNSYLVANIA FOR THE PROMOTION OF THE MECHANIC ARTS, ON THE EXPLOSIONS OF STEAM-BOILERS. PART II., CONTAINING THE GENERAL REPORT OF THE COMMITTEE.

(From the *Franklin Journal* for November.)

(Continued from p. 249.)

27. First. *Unduly heated metal may result from a deficiency of water within a boiler.* This seems to be a frequent and generally acknowledged source of explosion. The forcing-pump, by which a boiler is supplied with water, if at first well regulated, so as to furnish an adequate supply, and if kept constantly in action by the machinery, is subsequently liable to derangement of various kinds. The valves may be put out of order, the passages to or from the pump may be choked by sedimentary or saline matter. The pump may in some cases be heated so as to inject steam and not water. Any accident of this sort will cut off the due supply of water, and the level of that within the boiler will be lowered more or less rapidly. This will be true of self-acting, as well as of ordinary, means of supplying boilers. No one, we believe, has yet been applied, the working of which can, at all times, be relied on. There are, besides, cases in which the forcing-pump is not in action, when the production and use, or waste, of steam is going forward. In some stationary engines, the feeding of the boiler only goes on at intervals, and the due supply is therefore dependant on the attention of the fireman. The same is true of steam-boat boilers when the boat stops at a landing, and indeed the mischief is frequently increased by opening the safety-valve by hand, and allowing the steam, and of course the water, to waste freely. By an approximate calculation† it may be seen that to lower the water one inch in a cylindrical boiler with an interior furnace, or in a boiler of the same form where the fire is applied directly to the exterior, and with an interior flue, will require but from five to nine minutes. If by this depression an interior flue of eighteen inches should be laid bare for an inch in depth, between 102 and 103 square inches of surface would be subjected to the action of the fire, for every foot in length of the flue, supposed level.

28. It thus appears that by accident, or in the ordinary management of the steam-engine, a deficiency of water may occur, and highly heated metal be produced within a boiler. Recorded instances show that such has frequently been the case.‡

29. The metal, then, being softened by heat, may give way to the ordinary working pressure of the steam. This will, of course, depend upon the amount of this pressure, and upon the temperature which the metal has reached. The frequent rupture of boilers near the usual water-line, and in a horizontal plane containing very various thicknesses of metal, would lead us to suspect that this is connected with undue heating, which, if all circumstances were equal in the parts of a boiler, would take effect equally, at equal distances from the water-line. But the Committee have not before them any well-established instance in which a boiler without interior flues has exploded merely by the ordinary pressure of the steam, when the

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* If Col. Macerone will refer to our No. 680, he will find this same principle is now being carried very successfully into practice by Mr. Webster.

† In the case of a cylindrical boiler with an interior furnace and flue, calling l the length of fire-surface, d the diameter of the furnace, and π the ratio of the circumference of a circle to its diameter, $\pi l d$ = the extent of fire-surface. Then since in a boiler of this kind 1 sq. foot (144 square inches) of fire-surface can convert into steam ·356 cubic inches of water, per second; $\pi l d \times \frac{356}{144} =$ the number of cubic inches of water vaporised per second. Again, if we denote by x, the depression in the water-level in one second, c the breadth of the water-line, and assume the length of the boiler to be equal to that of the interior cylinder, $x c l$ will be an approximate value for the quantity of water vaporised. Equating the two values found, and cancelling l, we have $\pi d \times \frac{356}{144} = x c$. The depth of water may be assumed at two-thirds the diameter of the exterior cylinder, which, calling D that diameter, gives $c = \cdot 98$ D, and $\pi d \times \frac{356}{144} = \cdot 98 x$ D. The ratio of d to D in a number of cases in practice varies from ·4 to ·6 and even ·7; taking the lower limit or $d = \cdot 4$ D, we have $\cdot 4 \pi$ D $\times \frac{356}{144} = \cdot 98 x$ D. Whence $x = \cdot 003$ inches per second. Or to lower the level one inch would require 5 mins. 16 secs., supposing the water not to reach the interior flue.

For a cylinder with an interior flue, but where the fire is applied, externally, supposing the effective fire-surface to be half that of the boiler, the depression per second, will not be less than two-thousandths of an inch.

‡ As instances, may be taken, the boiler of the steam boat *Huntress*, N°. VII. Replies, &c. of the *Western Engineer*, No. II. Replies, &c. *Legislator*, *Eagle*, and *Massachusetts*, No. XVII. Replies, &c. Explosions at Pittsburg, No. XII. Replies, &c. and Jour. Frank. Inst. vol. iii. p. 70.

boiler had been unduly heated. The case of the explosion of a cylindrical boiler, at the foundry of Mr. M'Queen, in New York, may have been an exception to this remark, but the fact of the water having been very low, though rendered probable, is not entirely made out.* The copper boiler exploded in the experiments of the Committee, may be considered, however, as illustrating the possibility of such an occurrence.† The explosions in boilers with interior flues, arising from these circumstances, have been found to affect those flues which "collapse," that is, are crushed, and rent, and are frequently separated from the boiler. The case of the accident on board the steam-boat *Patriot*, which occurred near the mouth of the river Ohio, in 1828, distinctly illustrates this point.‡ It is stated that the engine was kept in motion after it was known that the water was below the flues; an act of temerity which was followed by the collapse of one of the flues.

30. It is highly probable, as will be seen hereafter, that water is thrown upon the hot metal, in cases where the engine has just been set in motion, or when the safety-valve has been opened, just prior to an explosion, and hence we are not warranted in adducing such cases here.

31. The following is a well authenticated instance in which the pressure was not sufficient to produce explosion, or in which the metal was cooled by its change of figure, but when the danger was obviously imminent. It was that of the boiler of the steam-boat *Legislator*,§ of which an oval flue was flattened by exposure to the steam-pressure, when known to be unduly heated. An explosion was avoided by the fire being put out, as soon as the deficiency of water was ascertained.

32. The Committee next proceed to consider the means which have been pointed out, by which, in the event of an undue heating of a boiler, water may obtain access to the heated metal.

Various means by which water may be brought into contact with heated metal, have been suggested. This may occur by the intentional or accidental removal of an obstruction, or by some other repair, to a forcing-pump,‖ or by the injection of water by a hand-pump.¶ When it is recollected that one cubic inch of water will produce six hundred and twenty-one cubic inches of steam of three atmospheres, or one hundred and eighty-nine inches of steam of eleven atmospheres, and that this steam is produced far more rapidly than in the usual action of the boiler, we are at no loss to understand that an ordinary safety-valve cannot give vent to it. The explosions on board of the steam-boats *Grampus*, *Constitution*, &c., should serve as warnings against the introduction of water into a boiler under such circumstances, and the course taken by the engineer of the *Legislator* as an example to be followed. In this latter case there can be no doubt, from the circumstances stated by Mr. Lester,** that an explosion was prevented by cooling the boilers previous to the introduction of water, when the deficiency was discovered. No circumstance of mere convenience should be suffered to interfere with such a course.

33. A second means assigned for bringing water in contact with unduly heated metal in a boiler, is by the foaming produced by the opening of a safety-valve, or in the ordinary working of the engine. This foaming has been abundantly demonstrated, and a detailed statement of the direct experiments made on the subject by this Committee, may be seen in their Report to the Secretary of the Treasury of the United States.†† Since the foaming is caused by making an opening in the boiler, it may be supposed that it cannot be adequate to do more than to produce steam to supply the place of that which escapes. This view of the subject derives some support from the experiments incidentally made by M. Arago,‡‡ and directly with this object by the Com-

* Thomas Ewbank "On the Explosion of Steam-Boilers," Jour. Frank. Inst. vol. x. p. 3. That the pressure was unusually great, is satisfactorily shown; and with or without undue heating, was, no doubt, the cause of the explosion. In the case of the *Etna*, the boiler was unduly heated, but, whether it gave way to the pressure, ascertained from the working of the engine, to be lower than usual, or whether water had access to the hot metal, is not known.

† Report of the Committee on Explosions, Part I. p. 68. Jour. Frank. Inst. vol. xvii. p. 225.

‡ Replies to Circular, &c. No. XXI. Thomas J. Haldermann, Esq. The explosion on board the *Tricolour* might be cited as another example. The boat was at rest. No. XXI. Replies, &c.

§ Replies to Circular, No. XVII. E. A. Lester, Esq., of Boston.

‖ In the case of the boilers of the *Car of Commerce* (No. VII. Replies, &c.) of the *Grampus* (No. XII. Replies, &c.) &c.

¶ See explosion of a boiler at Aston Forge (No. XI. of Replies, &c.) Boiler of the steam-boat *Constitution* (No. VIII. of Replies, &c.) &c.

** See Replies to Circular of Com. on Explosions, No. XVII. Letter of E. A. Lester, Esq. to Sec. of Treasury.

†† Reply to Query I. "To ascertain, by direct experiment, whether on relieving water heated to, or above, the boiling point, from pressure, any commotion is produced in the fluid." See also a paper by Mr. F. Peale, whose observations were contemporaneous with experiments of the Committee. Jour. Frank. Inst. vol. viii. p. 145, and Replies, &c. No. XXI. Potts on Explosions, Jour. Frank. Inst. vol. vi. p. 327.

‡‡ M. Arago. Sur les explosions, &c. Annuaire du Bureau des Long. 1830, pp. 148 and 190, and Jour. Frank. Inst. vol. v. p. 404, and vol. vi. p. 47.

mittee, but is contradicted by those of MM. Tabareau and Rey.* In the experiments of M. Arago, the boilers were not unduly heated; in those of the Committee, there was present a considerable amount of heated metal, and in those last referred to, and in which an increase in the elasticity of the steam was produced by opening a safety-valve upon a small boiler, the boiler was surrounded by a charcoal fire. There can be little doubt, then, that the result must depend upon the precise circumstances of the case, and that danger *may* result, though it does not *necessarily* follow, from making an opening in the boiler when the water is low. This effect from foaming would be increased, if in addition to the agitation produced by the first working of the engine, after stopping, the safety-valve should be opened. This was the common practice on the *Hudson* a few years since; the safety-valve being opened, by hand, on putting the boat in motion after the landing or taking up of passengers.

34. The successive explosions of connected boilers, such as occurred at the Polgooth† mines, and on board the steam-boat *Rhone*,‡ are easily explained if referred to the effect of foaming, and difficult to understand on any other principle, since just before the explosion of the second boiler a large opening was made for the escape of steam.§

35. It has been assumed by our countryman Perkins, in his hypothesis on the subject of the explosion of steam-boilers, that the hot steam formed by contact with unduly heated metal is the true source of danger. This opinion has been shown to be inconsistent with the deductions from sound theory.‖ The injection of water into hot and unsaturated steam, should reduce, not increase, its elasticity. With a view to ascertain if any circumstances had been omitted in the application of theory to this problem, the Committee made direct experiments on the subject. The water was introduced both in a full stream, and through small apertures. In no case, an increase, and in all but one a perceptible decrease, of elasticity in the hot and unsaturated steam, was observed. Fourteen ounces of water injected into steam at 533° reduced its pressure ·34 of an atmosphere.¶ The steam had in this experiment a temperature corresponding to the pressure of 60 atmospheres,** and an actual elasticity of only 6·82 atmospheres. There was besides a fire which supplied heat, as it was absorbed by the vaporisation of the injected water.

36. A correspondent has suggested†† that when a steam-boat is first set in motion, the inertia of the water may cause it to rise at one end of the boiler and then to oscillate, by which it would be thrown upon parts of the boiler which might be unduly heated. This is no doubt a true cause, but it would be difficult to say to what extent it would be effective. The subsequent suggestion that water can take a charge of heat in a latent state, which may be rendered free by mechanical means, the Committee do not conceive to be valid. Experiments which have been referred to as showing this, are fully explicable upon well-established principles.

37. There are two other important circumstances to be examined falling under this division of the subject, namely, the effect of the careening of a boat, especially one having connected boilers, and the effects of the sudden cracking of deposits of mud or sediment, beneath which the metal is unduly heated. These will, however, be treated under separate heads.

38. The Committee now proceed to examine *the means proposed for preventing the occurrence of the dangerous circumstances now under discussion*. These, of course, have reference, mainly, to the original source of the danger, that is, to the deficiency of water within the boiler, though an avoidance of the secondary causes might prove effectual.

39. First.—Various self-regulating apparatus for the supply of boilers have been proposed and partially used. Second.—Methods for ascertaining the level of the water, or of giving notice when it falls to a certain level, are in use, or have been suggested. Third.—Some methods for ascertaining the temperature of the boiler, or of particular parts of it, have been contrived.

40. 1st. One of the most common methods of regulating the supply of water to a boiler

* Ibid.

† J. Taylor, Esq. "On the Accidents incident to Steam-Boilers." Lond. Philos. Mag. vol. i. 1827.

‡ Annuaire du Bureau des Long. 1830, and Jour. Frank. vol. v. p. 401.

§ The same opinion is expressed by M. Arago, Annuaire, &c. p. 184. Translated in Jour. Frank. Inst, vol. vi. p. 49. The other cases referred to by him, in which an explosion followed the opening of a stop-cock by hand, as at Lyons, or of a safety-valve by the steam, as at Essone, may be explained by supposing the openings insufficient to give vent to the steam, which was produced by the action of the boiler, in the circumstances then existing.

‖ Dulong. Annales de Chim. et de Phys. vol. xlviii.

¶ In a certain theoretical case, namely, that in which all the heat to vaporise the injected water is derived from the hot steam, and the quantity of water which that steam can vaporise, without reduction of temperature below that of saturated vapour of the same elasticity, is injected, the precise reduction of elasticity has been calculated by M. Dulong. See Ann. de Chim. et de Phys. vol. xlviii. p. 378.

** Calculated from the formula deduced by MM. Arago and Dulong from their experiments.

†† Replies to Circular of Com. on Explosions, No. XX.

is by the use of the float. This is understood to have been entirely successful in the low-pressure boiler, the float being applied to raise a valve connecting a reservoir of water with the boiler to be supplied. A self-feeding apparatus in which a float was used was proposed by Mr. Charles Potts,* who exhibited to the Franklin Institute a very neat working model, in which a glass boiler was kept at nearly a constant level by this method. Its application is most difficult in the case of a small high-pressure boiler with interior flues.

Engineers differ very much in the amount of confidence which is to be placed in the float: those who have seen it in operation in the large boiler of a low-pressure engine give it implicit confidence; others who have tried it in the small high-pressure boiler, consider its action too uncertain to answer a good purpose,† even when in its best form. If the objections to the float are not valid, and we apprehend that they are only partially so, the real difficulty will be found to lie in general objections to all self-regulating apparatus. This obviously is one which is liable to get out of order, since it communicates between the exterior and interior of a boiler, and hence must have a packed joint, liable when the stem is not in constant motion to become tight, and therefore beyond the power of the change of buoyancy in the float to move.

41. A most ingenious method of feeding boilers was patented in 1825, by Mr. Eve.‡ It consisted of a revolving-cock, bored in part through, and playing alternately into the boiler, and into a box of water. It was expected that this cock being placed at a proper level of the water within a boiler, would merely draw out and return water while this was at a due height, but when it sunk too low would draw out steam and return water. The difficulty of condensing the high steam§ drawn out, and of making the returned water flow out of the openings, seems to have rendered this, as well as other promising schemes of the same sort, abortive.‖

An attempt to obviate these objections, which was seen by some of the members of this Committee, was unsuccessful. Mr. Charles Potts¶ has recently proposed a plan which is similar in principle. It will have to encounter the difficulty of the flow of water from moderately large openings when the pressure on the two ends of the column is the same, and the necessity for the alternate heating and cooling of the revolving-plug or chamber which acts as a feeder, and of at least a part of its contents. They agree entirely, however, with the Committee on Science and the Arts, that this principle merits further trial.**

42. The Committee are decidedly of opinion that no self-feeding apparatus has been, or is likely to be, invented which can be a substitute for the care of an engineer; and, indeed, they consider the carelessness which is liable to result from their use as a very serious, though not an insuperable, objection to them.

43. 2nd. Methods for ascertaining the level of the water in a boiler, or of giving notice when it falls to a certain level.

The imperfection of the gauge-cocks in ordinary use has been often pointed out, and indeed is generally admitted. Originating in the very infancy of the art in Savery's engine, they remain at this day a stain upon its more mature age. At best,†† when the water is tranquil within a boiler, they only show, roughly, the position of the water-line; and when it is above the highest cock, or below the lowest, they fail entirely; and cannot be placed far apart without making their indications, within these limits, too rude even for practice. When a boiler is in action, particularly if it is small and contains high-pressure steam, the foaming is so considerable as to interfere with their use. In the report of experiments by this Committee, abundant evidence is to be found of this imperfection; as an example of which may be taken the case, where by raising the safety-valve of the small experimental boiler, indications of water appeared at a gauge-cock, below which the hydrostatic level was known to be nearly two inches.‡‡

44. The method of indicating the level of

* Journal of the Franklin Institute, vol. vi. p. 42, and also p. 327, &c. where the apparatus is illustrated by a figure.

† D. J. Burr on the explosion of steam-boilers. Jour. Frank. Inst. vol. vi. p. 335. Mr. Redfield objects to its use in steam-boat boilers. See Report to Secy. Tres. U. S. in Doc. H. R., No. 478, session 1831-2.

‡ Lond. Jour. of Arts, vol. xii. p. 230, Lond. Mech. Mag. vol. vii. p. 344, Rep. Pat. Invent. vol. iii. p. 70. A revolving-wheel for the same purpose has been patented by Mr. Jesse Fox. Jour. Frank. Inst. vol. x. p. 161.

§ See also J. S. Williams' patent for supplying boilers with water. Jour. Frank. Inst. vol. vii. p. 183, which though different in action is liable to this objection, in even greater force.

‖ Walker's feeding-plug. Trans. Soc. Arts, &c., vol. L. Part I. p. 63. Sliding-valve and box. Lond. Mech. Mag. vol. xxi. p. 376.

¶ Journal of the Franklin Institute, May, 1836, vol. xvii. p. 302.

** Report on a "Plan of a new pump for feeding steam-boilers." Jour. Frank. Inst. vol. xviii. p. 3. 1836.

†† From the remarks which follow, exclusive of the objection on the score of the effect of foaming, we must except the shifting gauge-cock of Mr. Philos. Tyler, described in Jour. Frank. Inst. vol. xv. p. 178.

‡‡ Report of Com. on Explosions, Part I. pp. 11, 12, &c. Jour. Frank. Inst. vol. xvii. pp. 9, 10. Peale on the height of water in boilers of locomotives, Jour. Frank. Inst. vol. viii. and Replies No. XXI. Potts on Explosions. Jour. Frank. Inst. vol. vi. p. 329.

the water by a float* is liable to all the objections urged against the feeding apparatus, depending for its action upon that instrument. It has not, however, except in very rare cases, been used in this country. An alarm float was tried by the Committee, which is not subject to the objection in regard to the stuffing-box, since it is entirely within the boiler. This is by no means a new device,† though the particular arrangement was made by Mr. D. H. Mason for the Committee, and is figured and described in the first part of their report.‡ This device is intended to allow the escape of a small jet of steam whenever the water rises above, or falls below, a determinate level.§ The alarm by the issue of steam through a trumpet tube, being only applicable to engines working at very low pressures, does not require special notice here.

45. With due care on the part of the engineer, and the Committee are of opinion that no substitute has yet been found for such care, the glass tube affords the best means known to us, for observing the level of the water within a boiler. It seems strange that this excellent device which has stood the test both of experiment and of practice, has met with so limited a degree of favour. In the great progress made of late years, in the locomotive engine, it has been so clearly shown that engineers and their assistants can be induced to employ any machinery, the use of which is insisted upon, that the excuse of their indisposition to change should not be urged any longer. In this every case, in which the glass tube is probably more exposed to fracture than any other, it is practically used. The objection on the score of its breaking by unequal expansion and contraction of the glass, and of the metal with which it is connected, has been obviated, by passing the ends of the tube into stuffing-boxes; that on the score of its breaking by shocks, by giving it great thickness; and that of its breaking by sudden variations of temperature, by using well annealed glass. The difficulty of the glass clouding when high steam is used, by the action of the steam on the alkali, is got rid of by using green glass. The experiments which the Committee made on this apparatus were highly satisfactory, and they confidently recommend its use to practical men.‖

46. 3rd. The danger resulting from a deficient supply of water, being produced by the undue heating of parts of a boiler, many means have been proposed for showing such an increase of temperature, before it attains a dangerous degree. The fusible plates applied to the top of the boiler, may be intended to indicate the general temperature of the steam when saturated with moisture or not, or the local temperature resulting from the rising of hot and unsaturated steam, produced by unduly heated metal. In any case they will be exposed to pressure, though to less in the second case than in the first. The objections already urged, and derived from experiment, will apply to their use, in the ordinary way, in any one of these cases. Indeed, without this objection, it appears that as the source of danger is the heated metal, to this the indicator of temperature should be applied.

47. Various methods of indicating the temperature of a part or parts of a boiler have been contrived. One of the most simple is to apply the common thermometer, inserting the bulb and as much of the stem as is necessary, in a tube closed at one end and fastened into the boiler. The tube should contain mercury, through which the heat is conducted to the thermometer. Such a tube may be placed at or near the water line of the boiler, at the fire end of a flue, or in general at the place of a greatest exposure to heat from a deficiency of water, of which there will usually be one or more well determined, according to the form of the boiler. A mark upon the scale of the thermometer will show the temperature above which the metal must not be allowed to rise, either from an increased elastic force in the steam, or from a deficient supply of water. The fragility of the instrument, its inconvenient length or position in certain cases, and its not acting as an alarm, are the principal objections to its use.¶

48. The expanding rods proposed by Mr. Cadwallader Evans, are ingenious; they give, however, not the local temperature of the boiler, but its general temperature, along the lines to which the rods are applied. A much more appropriate device is the application of fusible metal, proposed by the same gentle-

* The hydrostat described in No. XXX. of replies is inadmissible, from the interior of the boiler being occupied by a second cylinder, leaving only an annular space for the production of steam. For the alarm-floats of J. L. Sullivan, Esq., see Silliman's Journal, vol. xx. p. 1.

† See the alarm-float of Siebe. Lond. Jour. of Arts, vol. xiii. p. 273. The first of those known to the Committee.

‡ Report, pp. 14, 15, Plate 4, fig. A. Jour. Frank. Inst. vol. xvii. pp. 13, 14.

§ It is exposed to a slight objection from steam-pressure acting to keep the disks upon the openings; these latter are, however, quite small, and the pressing surfaces of the disks may be regulated accordingly.

The float described by Mr. Ewbank, Jour. Frank. Inst. vol. x. p. 7, is also referred to by the Committee as deserving a full trial.

‖ See the description of the tube water-gauge used by the Committee in the first part of their Report. Jour. Frank. Inst. vol. xvii. p. 10. Mech. Mag. vol. xxv. p. 88.

¶ For a detailed description of the mode of applying the thermometer, see the Report of Com. on Expl. Part I. pp. 7 and 8, and Jour. Frank. Inst. vol. xvii. pp. 5, 6.

man.* This is intended to take the place of the ordinary fusible plate, and to avoid the difficulty originally existing, but since remedied,† of replacing the plate when it had fused. In the apparatus submitted to the Committee‡ by their chairman, and subsequently made the object of experiment, the fusible metal is applied to the most exposed part of a boiler; it is so small in quantity, that it will serve to indicate a local temperature, while the motion which indicates its fusion is independent of the quantity of fusible metal. These instruments are intended respectively to give notice when the steam, or the metal of the boiler, is exposed to a temperature much below that which would produce danger. Both of them, after giving an alarm, can be immediately restored to action, if the temperature within has been made to decrease.§

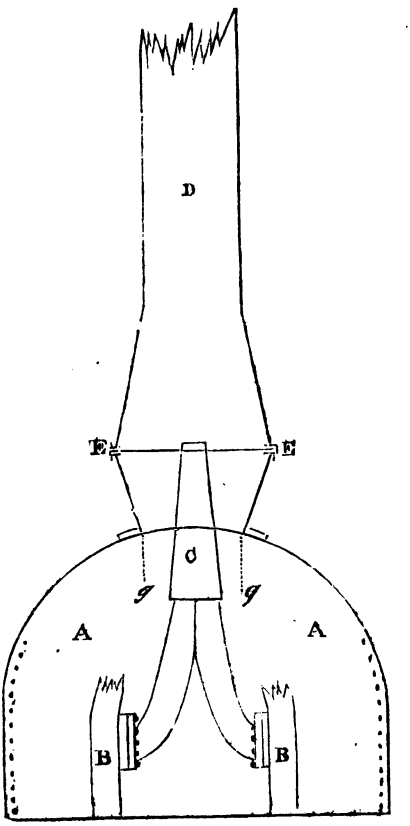
By very simple changes in the apparatus, the fusible metal might be applied to the boilers of locomotive engines.

(To be continued.)

RAILWAY-ENGINE SPARK-ARRESTER.

Sir,—In the report of the Select Committee of the Lords, to inquire whether any danger by fire is likely to arise from locomotive-engines on railroads, passing through narrow streets, the Committee say, "It does not, however, appear that as yet any plan has been devised, which could be described as being at once completely effectual, and, at the same time, not injurious to the operations of the engine."

Mr. Stephenson, and other eminent engineers, who were on that occasion examined, stated to the Committee several plans which had been tried, by putting sieves in the chimney, both at top and bottom; but that the effect was materially to injure the draught, and consequently the speed of the engine. The following method (of which I enclose you a sketch) seems to me to obviate the objections which are inseparable from the contrivances hitherto tried, and which (if you consider it has sufficient merit) I shall be glad to see inserted in your Magazine.



A A represents the hot-air chamber at the end of the boiler, into which the tubes from the fire-box lead, and from which springs the chimney D. C is the blast-pipe, which conveys the waste steam by the pipes B B, from the cylinders into the chimney, causing a vacuum, and consequent draught.

Now, my plan is, to stretch a wire-gauze across the chimney from E to E, *just* below the orifice of the blast-pipe, and, at the same time, to *widen* the chimney at the same point, so that when the gauze is in its place, the free-air way shall equal, or, if necessary, surpass in area the rest of the chimney.

When the gauze was tried at the bottom of the chimney, it was soon choked with cinders and dust, and speedily destroyed

* Communication to Com. on Explosions, No. XXII. of Replies, &c. Jour. Frank. Inst. vol. ix. February, 1832. Patented in May, 1834. See specification in Jour. Frank. Inst. vol. xiv. p. 391. The Committee prefer this to the apparatus acting by the expansion of mercury.

† Hall's method of applying the fusible plate. Bulletin de la Soc. d'Encouragement, &c.

‡ Described in Jour. Frank. Inst. vol. x. p. 217.

§ The apparatus devised by the Chairman of this Committee was made the subject of experiments, and, with them, described in Part I. of the Report of Com. on Expl. See Mech. Mag. vol. xxv. p. 118.

by the heat. In the present position this is obviated; and, if necessary, the more effectually to accomplish it, the chimney may be continued straight downwards for a short distance, in the direction of the dotted lines *g g*.

When the gauze was placed at the top, it had to allow *both* the hot-air and steam to pass, and consequently any attempt to reduce its meshes to a size proper to stop small cinders was unavailing; besides, large ones being once drawn up beyond the orifice of the blast-pipe, by the direct force of the steam, acquired such velocity and momentum, that on their arrival at the wires, the cinders were broken into small pieces and forced through, and being quite hot *till that moment* were still capable of doing much damage; and the wires themselves were fully destroyed by the continual blows of such large cinders. Now, by placing the gauze as I recommend, only the hot-air will have to pass (the steam coming out above), consequently the meshes need not be so large; it will be out of the way of the heat, and at that period of their ascent, the cinders will not have acquired sufficient force to destroy the gauze. And by widening the chimney at that point, which can be done at a very trifling expense and no inconvenience, any area of draught way may be obtained.

The cheapness and ease with which this may be applied to any engine, new or old, is not the least important consideration.

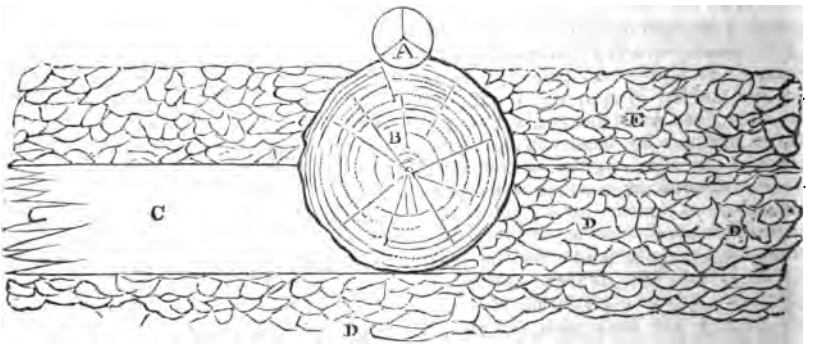
I remain, Sir,

Your obedient servant,

W. S. GREY.

1, Cloisters, Temple, Jan. 27, 1837.

ON LONGITUDINAL TIMBERS FOR RAILWAYS. BY JOSEPH JOPLING, ESQ. ARCHITECT.



Sir,—I beg to state that the *following* was prepared before I saw No. 172. It is supposed that few persons now, who have thought on the subject, are not convinced of the necessity for, and utility of, longitudinal timbers under rails for railways, on all embankments, in the first instance, at any rate; and I think it will be ultimately found, that generally, throughout the entire length of any railway, it will be the cheapest, at first, to adopt, this apparently temporary plan, and for the time, let it be considered such.

Where, however, there is no question respecting the firmness of the ground for a sufficient length, and where slate, or stone, can be procured, these will be more permanent. I had partly prepared a paper on this subject, before I left town last October.

Mr. Vignoles, however, has now opened the field, and given data for observation. I would, therefore, submit that there is still room for reducing the cost of railways, and to do so, I consider will ultimately be advantageous to all parties.

It may just be noticed, that Mr. V.'s longitudinal wood sleeper has not so much bed, neither has it any thing like the weight per yard, as the stone blocks on the London and Birmingham line. However, with the transverse pieces of a proper strength, sufficient in number, and properly attached to the longitudinal timbers, their stability, by means of the ballast, or especially concrete, may be greatly increased. A bed of concrete may be laid under the timbers, but ballast only will be better for the upper

part, as until the embankments have done settling, and the timbers and rails no longer require adjusting, it would not do to have the timbers surrounded by concrete.

It is worthy of consideration, whether the advantage of long timber is such, as to justify its use, at an increase of cost, and whether home timber, cannot be made appropriate, either by Kyanizing, or carbonizing: a method for performing the latter, with uniformity and facility, may be easily contrived. In this way, supposing it desirable to have larger timber, it may be used at less cost. Round timber, for this purpose, will, it is thought, have some advantages over square (saving sawing, &c.) both when first bedded and in every subsequent adjustment, which from the settling of embankments, &c. may be rendered necessary, and will be equally steady when properly connected by the transverse pieces, and bedded in concrete or ballast.

Any supposed inconvenience of short timber requiring many joints, will, it is thought, be more than counterbalanced by the facility of application and adjustment; and it is thought, a most effective and simple method of attaching the end of one longitudinal piece to another without any waste may be contrived.

It is submitted, whether much smaller rails may not be sufficient, for not only where longitudinal timbers and continued state or stone platforms are laid, but even where blocks are so near to each other as those at Chalk-farm, chairs not being required, and the rail being laid or bedded on the blocks, &c.

The form of rail that I would now propose is cylindrical. It is thought it may be under two inches in diameter.

The length of the rails cannot now be specified, but if the rail be partly let into the wood (as in the sketch), or other material, on which it may be bedded, as this will give it lateral strength, it may be of a greater length than if only laid thereon. Such a rail as this, it is thought, may be fixed as firmly, and more steadily to the bed, than any rail with flanges or chairs. I have tried rails one inch in diameter, for waggons carrying about two tons, which appear to answer well. Many fastenings may be contrived for this rail, but the best should have this property, that if a wheel be upon the rail its tendency should be to press upon the fastening; and if upon the fastening, its tendency should be to press upon the rail, and that both should have their bearing upon the sleepers or blocks; and allowance should be made for expansion and contraction. It may be further said in reference to fastenings, that those whose tendency is to compress the wood, slate, or stone, are preferable to those whose tendency is to split the material.

Again, those fastenings are the best which require the use of the simplest tools, and can be fixed, unfixed, and refixed with the greatest facility, and without any waste or injury to the materials, and without disturbing other portions of the work, should any part require to be taken up for any purpose whatever.

The edge of the wheels for such a rail may, for ordinary purposes, be concave, a little greater in diameter than the convexity of the rail; but for ascending, if not descending inclined planes, it is proposed for trial, that the concave edge of the engine wheels may be such, or be capable of being made such, by an adjustment, so as to press, with any degree of force, against each side of the rail, so as to give the wheel hold of the rail.

With respect to the diameter of the wheels, it is submitted whether they cannot, advantageously, be greatly increased, say, to at least 5ft. 3in. or 16½ feet, or one pole, in circumference, or some definite portion of a mile. All wheels should be entirely encased, and a frame may be raised above them, from which carriages may be suspended all round them, before, behind, between, and on each side.

In the accompanying engraving, A is a transverse section of the rail; B, the same of the longitudinal timber; C, the transverse tie; D D, concrete; E E, ballast.

The radiating lines on the section of the rail, show that if each be alternately placed at top, the whole surface of the rail may be brought into use.

Much more might be said on the above, but it would answer little purpose without experiment.

I am, Sir, your obedient servant,

JOSEPH JOPLING.

ON A CONJUNCTION OF THE SUN, MOON, PLANETS, AND SATELLITES; AND OF THE PERIOD OF THE OBLIQUITY OF THE ECLIPTIC TO THE EQUATOR. BY JAMES UTTING, ESQ., C.E.

(Read before the Royal Astronomical Society.)

On examining the motions of the planets and their satellites for different periods of time, I find that a conjunction of all the planetary bodies takes place after a period of 250904 solar years, in which are contained 91,640,740 mean solar days, supposing them to have been in conjunction at the commencement of the above period.

The following tables contain the number of years or revolutions of the planets round the sun, and of the satellites round their primaries during the above period, with the length of the year for each planet, also the period occupied by each satellite in revolving round its primary:—

	No. of Revolutions.	Days.	Hours.	Minutes.	Seconds.
Mercury	1041746	87	23	14	30·6867
Venus	407844	224	16	41	37·2372
Earth	250904	365	5	48	49·8855
Mars	133406	686	22	20	53·3049
Jupiter	21161	4330	15	26	9·3965
Saturn	8527	10747	3	0	51·9292
Uranus	2996	30587	16	43	34·6862
Moon	3354152	27	7	43	4·7129
Moon's Perihelia	28360	3231	8	6	25·8956
Moon's Node	13480	6798	6	35	15·1335
Sun's Perihelia	12	20908, $\frac{4}{5}$rds solar years.			

SATELLITES OF JUPITER.		
Sat.	Number of Revolutions.	Siderial Period in Days.
1	51799662	1·7691878
2	25805708	3·5511810*
3	12808731	7·1545526
4	5491162	16·6887700
	SATELLITES OF SATURN.	
1	97209895	0·9427100
2	66879335	1·3702400
3	48543670	1·8878000
4	33451874	2·7394800
5	20285765	4·5174900
6	5747194	15·9453013
7	1155190	79·3295821
	SATELLITES OF URANUS.	
1	15551835	5·892600
2	10525192	8·706800
3	8360542	10·961100
4	6810450	13·455900
5	2406848	38·075000
6	850933	107·694425

* In Mr. Baily's Astronomical Tables, &c. (1827), the period of this Satellite is stated at 3·551810, &c.; it should, however, be 3·5511810, as given above.—Vide *Exposition Du Système Du Monde*, par M. Laplace. 4th Edition, p. 135.

Secular Motions of the Planets in Longitude derived from the above Periods.

	Revolutions.	Signs.	Degrees.	Minutes.	Seconds.	Decimals.
Mercury.....	415	2	14	6	40	036752
Venus.....	162	6	19	10	40	009935
Earth	100	0	0	45	52	068567
Mars	53	2	1	39	20	552479
Jupiter	8	5	6	16	10	403513
Saturn	3	4	23	29	23	764979
Uranus.....	1	2	9	52	43	391566
Moon	1336	10	7	52	47	472371
Moon's Perihelia.....	11	3	19	12	44	814688
Moon's Node.....	5	4	14	10	2	175670
Sun's Perihelia	0	0	1	43	18	518257

The latter table contains the mean motions of the planets in longitude for a period of 100 years in respect to the equinoxial points; but which motions are, however, subject to a secular variation, arising from their mutual attractions. The solar or tropical year is consequently a variable quantity for all the planets but their periodic times in respect to the fixed stars; and the greater diameters of the planes of their orbits, was the same a million of years since, and will be the same a million of years hence, as at the present time.

The secular precession of the equinoxial points at the present time is 1° 23′ 30″. The above period contains ten revolutions of the precession, with a mean secular motion of 1° 26′ 5″ in a century; but I cannot, at present, state whether this comes within the limits of the *secular variation*. If so, the *siderial* periods of the planets will contain ten revolutions less, and the *tropical* periods of the satellites ten revolutions more, than are given in the above tables.

In respect to the variation of the obliquity of the ecliptic, Laplace states the maximum variation at 1° 21′, which is the extent of the oscillations on either side of the mean obliquity, 2° 42′ being the total extent of the variation. One period of the oscillation is completed in 41,817⅓ years; consequently, six oscillations are performed in 250,904 solar years, which gives 46″.4879 for the mean secular variation of the obliquity, which agrees extremely well with modern observations.

A singular approximation presents itself between the siderial periods as above stated, and those given by Mr. Baily in his tables, in respect to the satellites of Saturn and Uranus. In my tables, the decimals are extended to two places of figures more than are given in Mr. Baily's, and in ten cases out of thirteen, the last two figures are cyphers, but which are all given to the nearest unit, having been computed to ten places of decimals by dividing the 91,640,740 days by the number of revolutions of each planet respectively! Now for a word or two as to theories. We have recently been presented with a liberal supply of theories to account for the effects produced by what, in the Newtonian theory, is termed gravity or attraction; and likewise to account for the stratification of the exterior crust of the earth, the origin of the different substances of which the earth's surface is composed, &c.

In respect to the first, we see the effects produced, but the cause, or by what means these effects are produced, remains a mystery; which will, I predict, be discovered much about the same time as the philosopher's stone and the perpetual motion! I am not, however, going to enter a discussion of the above subjects at the present time, but merely to offer a few remarks on the effects pretended to have taken place in consequence of either the motion of the equinoxial points, the earth's perihelia, the obliquity of the ecliptic, or the excentricity of the earth's orbit.

It has been contended by different theorists, that the various stratas that compose the earth's surface, have been deposited by the alternate revulsion of the waters of the ocean from the north to the south pole, and *vice-versa*. Now, in regard to the motion of the equinoxial points, it is very well known to astronomers, that the apparent situation of the fixed stars are constantly changing; their longitudes and right ascensions being reckoned from the first point of Aries, but which point is not stationary in respect to

the fixed stars, owing to a retrograde motion of the equinoxial points, which occasions the solar or tropical year to be about 20¼ minutes of a degree shorter than the siderial year, or revolution of the sun in respect to the fixed stars. For the correction of the equinoxial points in right ascension and declination, see my tables in the 1st vol. of the Rev. Dr. Pearson's *Practical Astronomy*, pp. 281—286.

The present Polar star, according to Leadbetter, will in the year 15064, be 8° 56′ 49″ south of the zenith of London. Now, it is a mistaken notion altogether, to suppose that the latitudes or longitudes of places on the earth's surface vary from this circumstance, as there has not been the least variation in the latitude of places in respect to the Poles, discovered from the remotest period to the present time. It being in the right ascensions and declinations of the fixed stars in which, in this case, the variation is apparent.

The perihelion point of the earth's orbit is that in which it is nearest the sun. The aphelion is, consequently, the point in which the sun is farthest distant from the earth; the line connecting these two points is called the line of the apsides, which is not stationary, but has an annual motion of 11″.8 in respect to the fixed stars; but in regard to the ecliptic, it has an annual motion of 61″.9 on account of the precession of the equinoxes. The motion of the perihelion point will not influence the waters on the earth's surface, or give them a tendency to accumulate more at one pole than the other; it is true, the sun is nearer when in perihelion than in aphelion, and has a greater attractive power in one case than in the other; but this is occasioned by the excentricity of the earth's orbit. If the orbit of the earth was a circle, the line of the apsides would vanish, and there would be no aphelion or perihelion points.

In regard to the obliquity of the ecliptic, it has been demonstrated, as before mentioned, that the variation of the obliquity is confined within narrow limits, and which is occasioned by the mutual attraction of the planets. The earth being protuberant at the equator, the sun has a greater attractive power on that side of the earth which is nearest him, than he has on the other side, which is more remote, on account of the difference in the distance, or nearly equal to the earth's diameter. Consequently, the excess of the sun's attraction will have a tendency to bring the equator more under the sun, in opposition to the attractions of the planets in a more oblique direction to the plane of the equator. Besides, were the sun perpendicular at the poles, there would still be no perceptible difference in the tides; as we have frequently higher tides in the winter, when the sun's altitude is least, than we have in summer, when his altitude is greatest.

The excentricity of the earth's orbit is at present diminishing, and will, probably, continue to do so till the orbit of the earth becomes a circle; after which, the excentricity will again increase to a certain amount (being confined within narrow limits); but the period of this variation includes, as well as that of the moon's acceleration, millions of years. The acceleration of the moon being produced in consequence of the diminution of the earth's excentricity, on which it is dependant. When the earth is in perihelion, it is about three millions of miles nearer to the sun than when in aphelion, and yet we observe no perceptible differrence in respect to the tides.

The only circumstance which could effect a transmission of the waters from one pole to the other, is an alteration in the direction of the earth's axis of rotation, or in its polar diameter; and, consequently, new equators would be acquired, to which the waters would accumulate from the effects of the earth's centrifugal force; and thus, by a shifting of the axis of rotation, would cause an elevation of the waters in succession from the North to the South Pole. But that this circumstance never took place, is evident from the known figure of the earth and planets being oblate spheroids, which, in all probability, took this form from the effects of their rotation, when in a liquid or soft state.

The planes of the equators of the earth and planets cut through the centres or middle of these protuberances at right angles to their polar axis. Hence, it appears evident that the planets revolve on the same axis now, as they did previous to their being in a consolidated state. That the surface of the earth has undergone numerous mutations, is evident; but which could not have been effected by a slow and tardy motion, like that of the shifting of the earth's axis. The greatest revolutions on the earth's surface, appears

to have been caused by some internal convulsions, by volcanoes, or earthquakes.

As there has been numerous blocks of stone found on the earth's surface, some forty or fifty miles from their parent rock, may not some three or four of Mr. Mackintosh's moons,* which were originally attendant on the earth, have fallen to its surface and broken into fragments? This would account for the abrupt and rocky appearances of various places on the earth's surface. But, by-the-bye, I cannot see, as he says, "the earth was formerly much larger than it is at present," how it can be smaller now, after the acquisition of these three or four moons, than it was originally! A very copious discharge of the electric fluid from the earth would be required to sweat it down from its original, to its present dimensions!!

In conclusion, I beg to observe, that the above period of conjunction may be objected to on account of the length of time occupied in its completion. It appears from the latest discoveries of geologists, that the revolutions which the earth has undergone, must have occupied a much longer period of time than that assigned by Moses, for the creation of the world; but this does not militate in the least against the testimony of Moses, as he does not say that the earth was then created, but that "it was without form and void, and darkness was upon the face of the deep:" from which it appears the earth was in existence previous to the time to which he alludes; and might, probably have undergone some dreadful catastrophe, which destroyed all its former inhabitants, if any existed. As there are hundreds of volcanoes in an active state of ignition at the present time, and also a great number which have become extinct, may not their origin have been occasioned by a general conflagration? or how are we otherwise to account for so many burning mountains dispersed over the earth's surface?

If a conflagration is admitted antecedent to the creation of man, as recorded by Moses, a great part of the waters which now cover the earth's surface, would, by the intense heat of the earth, have been converted into vapour, and suspended in the atmosphere, which, together with clouds and smoke, would have obscured the sun, whence darkness would have been on the face of the deep, as related by Moses. We are also taught to believe that the world will, at some future period, be destroyed by fire; but it is not probable that the earth will be annihilated, as it may, after this catastrophe, be rendered a more delightful residence for a future race of intelligent beings than it is at the present time.

We have the greatest reason to suppose that the fixed stars are suns, attended by planetary bodies, with their attendant satellites or moons, similar to those of our system; and that they are, in all probability, inhabited by intelligent beings, of whose nature and constitution we can form no conception, as the Almighty has made nothing in vain. Of his kingdom there is no end, neither as to time or space. As an illustration, suppose the number of fixed stars, visible in our best telescopes, to amount to one hundred millions, exclusive of their attendant planets and satellites, and that the Almighty had created as great a number of systems as above stated, in every second of time, during a *nonillion*† of years, they would still be very far short of occupying one *nonillionth* part of infinite space, admitting them all to be placed at the same distance from each other as the fixed stars!

There may be stars placed at a distance from us so remote, that a body moving with a velocity of a *nonillion* of miles in one second of time, would occupy a *nonillion* of years in passing from them to our earth!! These numbers are, however, far above our comprehension, it being impossible for finite beings to comprehend infinity.

I am, Sir, Yours, &c,
JAS. UTTING, C. E.

Lynn Regis, Dec. 20th, 1836.

* *Mechanics' Magazine*, vol. xxiv. p. 234.

† A *nonillion* is a million nine times repeated; its value is equal to unity followed by 54 cyphers.

SIR JOHN SOANE'S MUSEUM.

It has been already stated in the *Mechanics' Magazine*, that the splendid museum and library of the late Sir John Soane have become vested in the nation by his decease. By a clause in the Act of Parliament, by which Sir John was empowered to carry his intentions into effect, it was, however, provided that in case he should choose to leave his collection, by will, to the British Museum, there to be preserved separately, with the title of "The Soane Collection," the house in Lincoln's-inn-fields, together with the

proposed endowment for the support of the Museum, should be considered a part of his private estate, and descend to his heirs, instead of to the nation. We believe the purport of the will is not, at present, known; but it is most probable that the original intention of Sir John, as developed in the Act of Parliament, will not have been interfered with by its provisions; and that, consequently, the mansion, as well as its contents, may now be looked on as public property.

It seems, by no means, to have been intended by the donor, that admission to his collections should be granted to the public as liberally as is now the case at the British Museum. The Act directs, that "free access shall be given at least two days in the week, in the months of April, May, and June," to "amateurs and students in painting, sculpture, and architecture, and to such other persons as shall apply for and obtain admission thereto, at such hours, in such manner, and under such regulations, for consulting and inspecting, and benefitting by the said collections, as the said Sir John Soane shall have established previous to his decease." From this it will appear how erroneous is the prevalent idea, that the restricted admission granted by Sir John during the last two years; was merely provisional: and that as soon as the Museum became public property, the public were to be admitted to it as freely as to the pre-existing national establishment. It may be remarked, however, that the trustees have the power to establish new regulations, and that, if they do, they will most probably tend to the increase of facilities of admission. If it become the regular state of things for the Museum to be open only two days in the week, for three months in the year, and that only to the select few who are able to procure tickets of admission, it will be a *public* institution in name alone.

There would be no pecuniary difficulty in the way of affording more extended admission, as the Act empowers Sir John to invest 30,000*l.* in the public funds; out of the interest of which, the "Curator" of the institution is to be paid a salary of 300*l.* per annum, in addition to which, he is to reside rent-free in the mansion. The Act provides, that the curator shall be appointed (after the first, who is to be named in Sir John's will) by the Council of the Royal Academy, and that he must be "an English architect, who shall have distinguished himself, or gained a prize." The trustees are partly to be elected by the survivors of the original trustees named by Sir John, with the addition of five elected respectively by the Lord Mayor and Aldermen of London, the Royal Academy, the Royal Society, the Society of Arts, and the Society of Antiquaries. Of course, should the collections have been left to the British Museum, all these provisions will be cancelled.

The exterior of the "Soanean Museum" is pretty well known to the London public: of the interior they know but little (and are likely to know little, if the restrictive directions of the Act be too closely complied with), except from the work devoted to its illustration, published a year or two ago, by Mr. Britton. At the latter end of 1835, Sir John Soane himself also *privately published* a work of the same description, with numerous embellishments, from which a general idea of the Museum and its contents may be gathered. The arrangement of the interior would seem to be a curious amalgamation of the private gentleman's residence with the public museum. Thus, one of the principal apartments combines in itself the characters of dining-room and library; the "Sepulchral Chamber" is in rather close contact with the breakfast-room; and picture-rooms and bedchambers, dressing-closets and model-rooms, &c. &c., are jumbled together in most admired disorder. As the mansion, even when thrown open, is still to be the residence of Sir John's grandson, we suppose the restrictions as to access, which have been alluded to, were dictated by a wish to preserve his domestic comfort, which might indeed be seriously compromised, if the public were to use the same apartment for a library which he required at the same time for a dining-room!

The great "lion" of the collection, it is well known, is the Sarcophagus, brought over by Belzoni, from Egypt. It is of alabaster, of exquisite workmanship, and literally covered with hieroglyphics. It was offered, after it had been publicly exhibited for some time, by Belzoni's widow, we believe, to the British Museum. For what reason, it is not stated, the authorities of the Museum refused to purchase, and Sir John Soane immediately after became its pos-

sessor at the same price—2000*l.*, for which it had been offered to the nation. It is now placed at the centre of an apartment prepared expressly for its reception, and appropriately ornamented in the Egyptian style. The other principal treasures of the collection are a vast number of architectural models and drawings of all countries, and almost all eras, the lead being taken by the various designs on which Sir John Soane most prided himself; including especially the Bank, the National Debt Office, and the Council Chamber, among those which *were* executed: and among those which were *not*, two designs for a royal palace, one drawn at Rome about 1770, and the other at London in 1821; a view of a proposed triumphal bridge, which gained the Royal Academy prize sixty years ago; and the plans for new Houses of Parliament, which received the approbation of the Legislature so long ago as 1794, but, as all the world knows, were never carried into effect. The collection of architectural books is particularly valuable; nor is the library at all deficient in literary curiosities of a more general character. It possesses the splendid copy of the great work on Egypt, presented by the Institute to Denon; and another work, an *unique*, of inestimable value—the original MS. of the "Gierusalemme Liberata," in the hand-writing of Tasso himself!

The mind of Sir John Soane appears to have been rather deeply tinged with eccentricity. The two great men he held in highest estimation, were apparently Napoleon Bonaparte and William Pitt! He placed the highest possible value on a miniature of the former, which purports to have been taken in the early part of his career, expressly for the (future) Empress Josephine; and portraits and statues of the latter are profusely strewn throughout the collection—one, most appropriately, being placed on a model of the National Debt Office! The collection of pictures is in all respects of high excellence, and particularly rich in the works of modern British artists, of whom Sir John was a warm patron. He possessed some of the finest works of Lawrence, Wilkie, Westall, Stanfield, and a host of others; and the ceiling of the library is splendidly decorated with paintings from the classical pencil of Howard. To sculpture the same remarks will apply. Sir Francis Chantrey is one of the original trustees nominated in the Act, and his productions, with those of Westmacott and other distinguished professors of the British school, hold a prominent place in the Fine Arts department of the Museum.

It is to be regretted that Sir John entertained so rooted an antipathy to his two surviving sons: it is painfully apparent even in the pages of the work devoted to a description of his "House and Museum," and seems to have originated from an impression on his mind, that they had attacked his professional reputation through the medium of the press. Be that as it may, it will hardly be worthy of the nation to take possession of the father's treasures of art, without making some provision for the sons; if it be the case, as it is understood to be, that they are (one of them at least) in destitute circumstances, and without any hope of deriving benefit under Sir John's testamentary disposition of his property.

PROCESS OF EVAPORATION.

Sir,—If W., p. 239, will carry his experiment of the inverted tumbler a little farther, he might easily ascertain how much rarefied air would pass through the bottom of the vessel; as soon as he perceives all, or the greater part of the water to have been driven from the inverted glass, let him remove the whole apparatus together from the fire that it may cool, and when cold, I am much mistaken if he does not find the tumbler again filled with water, thereby proving that not a particle of atmospheric air has passed through the bottom of the boiler. The water to be used in this experiment should be previously boiled.

The small bubbles, which he says form at the bottom of the vessel at the commencement of the operation, he will find to cover the sides also; but he will find the same appearance in a glass after it has stood still some time full of water, the said glass being thoroughly dry at the time of filling it: there can be no doubt that these bubbles are atmospheric air, and if removed by agitation or any other means, they will not form again. Now, these bubbles I take to be formed by the breaking up of a very thin stratum of air which adhered to the inner surface of the vessel, and prevented the water from coming into immediate contact with the glass.

Yours, &c. Trebor Valentine.

MR. CROSSE'S OWN ACCOUNT OF HIS EXPERIMENTS.

(Extract of a letter from Mr. Stutchbury, of the Bristol Institution, to the Editor of the *Bristol Guardian*, dated Feb. 1, 1837.)

"I feel it a duty due to the cause in which I am engaged, and to the philosopher with whom they have originated, at once to take the liberty of transmitting to the press, and particularly the local press, from which so many reports have emanated, an abstract of a letter I have received from Mr. Crosse, with an account of his experiments, in the language of a private communication (not that which he would probably have chosen had he made the communication himself), and without further comment.

"The following is an accurate account of the experiments in which insects made their appearance:—Experiment the first. I took a dilute solution of silicate of potash, supersaturated with muriatic acid, and poured it into a quart basin resting on a piece of mahogany and a Wedgewood funnel in such a manner that a strip of flannel, wetted with the same, and acting as a syphon, conveyed the fluid, drop by drop, through the funnel upon a piece of somewhat porous Vesuvian red oxide of iron, which was thus kept constantly wetted by the solution, and across the surface of which (by means of two platina wires connected with the opposite poles of a voltaic battery, consisting of nineteen pair of five-inch plates in cells filled with water and 1-500 muriatic acid) a constant electric current was passed. This was for the purpose of procuring crystals of silex. At the end of fourteen days I observed two or three very minute specks on the surface of the stone, white, and somewhat elevated. On the eighteenth day, fine filaments projected from each of these specks, or nipples, and the whole figure was increased in size. On the twenty-second day, each of these figures assumed a more definite form, still enlarging. On the twenty-sixth day, each assumed the form of a perfect insect, standing upright on four or five bristles which formed its tail. On the twenty-eighth day, each insect moved its legs, and in a day or two afterwards, detached itself from the stone and moved at will. It so happened that the apparatus was placed fronting the south, but the window opposite was covered with a blind, as I found these little animals much disturbed when a ray of light fell on them; and, out of about fifty which made their appearance at once, at least forty-five took up their habitation on the north side of the stone. I ought to have added, that when all the fluid, or nearly so, was drawn out of the basin, it was caught in a glass bottle placed under a glass funnel which supported the stone, and was then returned into the basin without moving the stone. The whole was placed on a light frame made for the purpose. These insects have been seen by many of my friends, and appear when magnified very much like cheese mites, but from twice to eight times the size, some with six legs, others with eight. They are covered with long bristles, and those at the tail, when highly magnified, are spiney. After they have been born some time they become amphibious, and I have seen them crawl about on a dry surface.

"Experiment the second. I took a saturated solution of silicate of potash and, filled a small glass jar with it, into which I plunged a stout iron wire, connected with the positive pole of a battery of twenty pairs of cylinders filled with water alone, and immersed in the same a small coil of silver wire connected with the *negative* pole of the same battery. After some weeks' action gelatinous silex surrounded the iron wire, and, after a longer period, the same substance filled up the coil of silver wire at the other pole, but in much less quantity. In the course of time one of these insects appeared in the silex at the negative pole, and there are at the present time not less than three well formed precisely similar insects at the negative, and twelve at the positive pole, in all fifteen. Each of them is deeply imbedded in the gelatinous silex, the bristles of its tail alone projecting, and the average of them are from half to three quarters of an inch below the surface of the fluid.

"In this last experiment we have neither *acid*, nor *wood*, nor *flannel*, nor *iron ore*. I will not say whether they would have been called to life without the electric agency or not. *I offer no opinion, but have merely stated certain facts.*"

NOTES AND NOTICES.

The M'Adam Memorial.—A meeting was held at Spring-gardens on the 24th of January, the Duke of Richmond in the chair, to consider the propriety of raising a subscription for the erection of a suitable memorial of the services of the late John Loudon M'Adam. Resolutions to the effect that such a proceeding was highly expedient were carried unanimously, and subscriptions to a large amount have been already raised. It is, *of course*, reported that the proposed monument is to be a full-sized copy of the celebrated Colossus of *Rhodes*.

Mr. Collier offers to give F. H——d the explanation he requires (see No. 701), if he will furnish Mr. C. with his name.

"Q." may have the information he requires with respect to his proposed patent, by calling at our office.

Errata.—Page 329, column 1, line 5, for "*stabilstichen*" read "*stahlstichen*" (steel-engravings).

P. 348, col. 2, line 7 from bottom, for "expensive" read "extensive."

P. 349, col. 1, line 13, for "only one, America," read "only one America."

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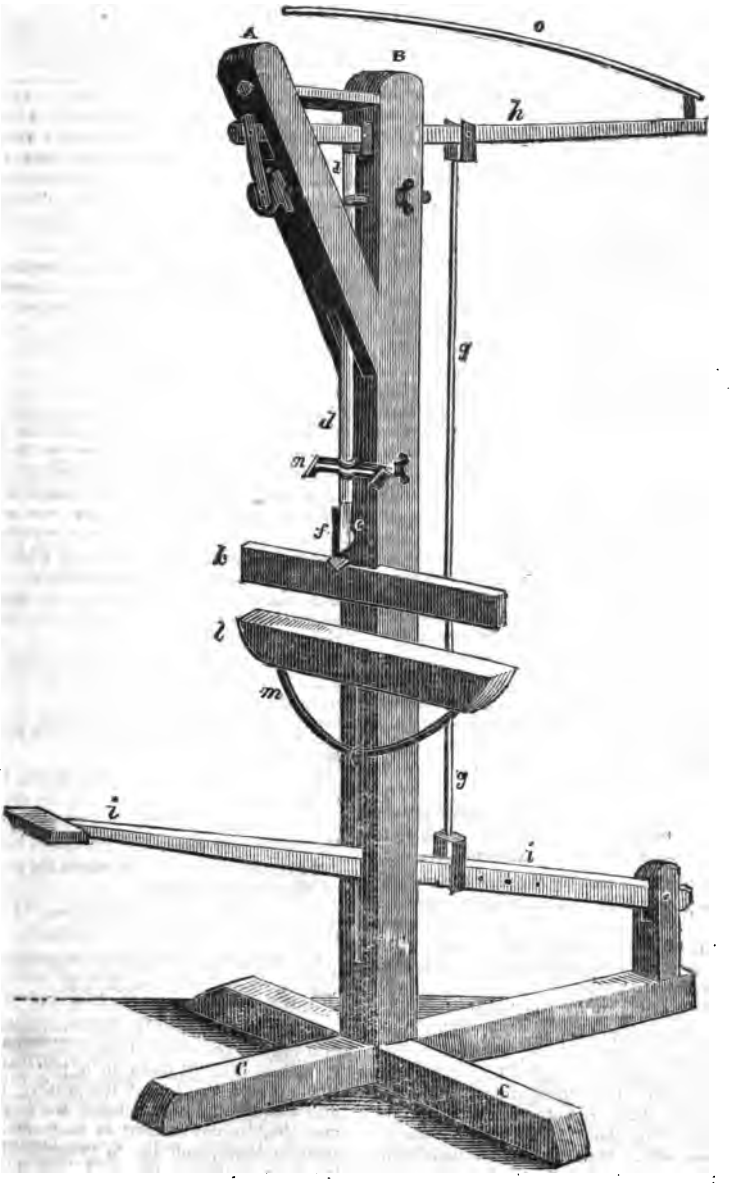
PAGE'S MORTICING-MACHINE.



PAGE'S MORTICING-MACHINE.

At the Fair of the American Institute, in October, 1835, Mr. George Page, of New Hampshire, was awarded a silver medal, for a morticing-machine, the following description of which we extract from the *American Railroad Journal*:—

"C C B A (see front page), the frame, consisting of two cross pieces or sills, with an upright post from their centre, and a piece projecting upward in front at an angle.

"*d d*, the slide, with a socket in the lower end, into which the chisel is inserted. This slide is of iron, connected with the lever *h*, and sustained in its place by two boxes passing through the upright, which are regulated by thumb-screws on the side of the post.

"*e*, the chisel; it is made of cast steel, about six inches in length, from ¼th to an inch diameter. The cut is perpendicular on one side, and bevelling on the other, with side-cutters, projecting backward about one-fourth of an inch, which serve not only to make the sides of the mortice as smooth as the ends, but also to clear the chips as the chisel is withdrawn from the mortice. This chisel is either single or double, cutting one or two mortices of equal width and depth at the same time. It has also a tool for making *dowells*, and another for cutting holes in Venetian blinds for the cord to pass through. The two latter are of much use, especially that for making dowells, or pins of any size, from one-fourth to an inch diameter, and 4 to 6 or 9 inches in length; and the other performs at one pressure of the foot an operation which in any other way requires five times the labour.

"*f*, the stop which is made fast to the upright by a bolt and thumb-screw, to prevent the timber from rising when the chisel is drawn up by the spring.

"*g g*, the connecting rod between the lever *h* and the treadle. The rod is moveable, to accommodate the depth of the mortice.

"*h*, the lever passing through the upright post and front brace, to which it is connected in front by two straps of iron. The lever is about three feet in length, and at its extreme end, connected with a spring poll to raise the chisel from the mortice.

"*i i*, the treadle or foot-board, by which the machine is put in motion. This foot-board is also like the lever, about three feet in length; passing through a long mortice in the lower part of the upright post, and made fast at the back end to a short upright standard rising about 14 inches from one of the cross sills. It is then connected by an iron rod in the rear of the upright post with the lever at the top, which rests upon the slide *d d*, into which the chisel is inserted. The lever *h*, acts upon a pivot in front, resting at about nine inches from the pivot, upon the top of the slide *d d*, which is moveable, and is connected by a rod with the treadle *i i*, which acts upon a pivot at the extreme back end. By placing one foot upon the foot-board, and pressing it down, the end of the back lever *h*, also descends, and causes the chisel to perform its office upon the timber, which is laid upon the rest *l*. It will be readily perceived that a powerful leverage is obtained by this arrangement, and that a rapid motion is easily produced with the foot by which the chisel is driven into the timber, and drawn out again by the aid of the spring pole.

"The timber to be morticed is placed in its place on the rest *l*, until it receives a thrust from the chisel, when it is moved forward one-eighth of an inch by hand, or otherwise, as the chisel rises and falls again by the aid of the foot. When the mortice is headed down at one end to its proper depth, the chisel is turned the half of a revolution by the aid of a spring and moveable box *n*, and again confined by a spring in a proper position, and the timber is caused to retrace its course, and the mortice is completed to a uniform depth, and headed down at the other end; and on turning it over, the chips will either drop out, or may be easily picked out, as the chisel is so constructed with side-cutters as to cut at both sides as well as at the end; and therefore the mortice is not only perfectly true or uniform in its sides, but also smooth or free from splinters, arising from cross grain, as is frequently the case in the ordinary mode of morticeing.

"*k*, a back-board or fence which serves to keep the timber parallel.

"*l*, the rest or bench on which the timber to be morticed is laid. It may be raised or lowered or placed at any desired angle to suit the nature and size of the work.

"*m*, the half circle, by which the position of the rest is regulated.

"*n*, the box and thumb-spring, by which the position of the chisel is regulated.

"*o*, the spring-pole (shown in part), which acts upon the lever *h*, and of course the slide and chisel which are connected with it.

"It will be readily perceived, that by pressing the foot-board down to C, the chisel *e*, will be brought down in a perpendicular line near to the top of the rest *l*; and it may be repeated a hundred times a minute, and thereby cut a mortice three inches or more in depth, and six to twelve inches in length, according to the wood, in a minute."

LANE'S MODERN EGYPTIANS.

The Society for the Diffusion of Useful Knowledge has just favoured the world with an original work of considerable interest, on the subject of the modern state of Egypt.* Like Mr. Davis's work on China, it is got up in a style of general resemblance to the Society's series, "The Library of Entertaining Knowledge," but, also like that, it takes its station as an independent work, and challenges attention on the ground of its own merits, without calling to its aid the imposing array of names of Committeemen, &c. which usually graces the publications issued under the same imposing auspices. Luckily, it possesses sufficient merit of its own to enable it to dispense with such a cumbersome support.

The work owes its origin to a sojourn made by its author in Egypt in 1825 and the three following years, mainly for the purpose of acquiring that familiar acquaintance with the Arabic language, which could only be expected to result from a residence of some length amongst a people with whom it is the mother-tongue. Some of the notes made by Mr. Lane on that occasion, he tells us, fell into the hands of certain members of the Useful Knowledge Society, who entertained such an opinion of their value, that he was induced to make his second visit with the express intention of completing and extending them for publication. The result is the work before us, small portions of which have already appeared, from time to time, in the pages of the *Penny Magazine*, but only in sufficient quantity to whet the edge of appetite: the great mass of its contents is altogether new.

Of the antiquities of Egypt, Mr. Lane, in his present work at least, has nothing whatever to say, nor of its ancient history. He confines himself to a descriptions of the manners and customs of its living inhabitants, devoting none of his space to dissertations on the probable intentions of the builders of the pyramids, and taking neither one side nor the other in the discussion as to the meaning of the hieroglyphics which abound in them; and yet, without the assistance of either pyramids or hieroglyphics (component parts, as it were, of the idea of Egypt), he has contrived to produce two volumes not deficient either in interest or importance. He enjoyed peculiarly favourable opportunities for observing the interior life of the Moslem Egyptians, from the intimate knowledge of their language which he acquired, and from his conforming to the utmost possible extent, to their national customs and religious prejudices, so that, as he very complacently informs us, he passed, among all but his most familiar acquaintance, for an indifferent good follower of Mahomet, and gave no outward indication, by dress or manner, that he was not "native, and to the manner born." Such precautions were, of course, absolutely necessary in the acquisition of that minute information on domestic life, of which a great portion of the work consists; and fortunately our author did not put off the insatiable curiosity and the observant eye of the Frank, along with the Frankish costume.

The first volume opens with an introductory chapter on the general characteristics of the country and its climate, with a very particular description of Cairo, and especially of the construction of its houses, the arrangement of its streets, and the general appearance of its inhabitants. This is full of information, and the letter-press is powerfully assisted by the numerous illustrative wood-cuts with which it is interspersed. Among these, a view of a street in Cairo, showing the arrangement of the shops of the Egyptian capital, and two views of the exterior and interior of a private mansion, are particularly deserving of attention, having evidently been executed with elaborate minuteness, and with every appearance of complete fidelity. The chapter which follows on the "Personal Characteristics and Dress of the Moslem Egyptians," is of similar interest, and also profusely illustrated; but this yields, perhaps, in importance to that "On Infancy and Early Education," by which it is succeeded. This is full of entertaining, if not instructive matter, and gives, on the whole, but a low idea of the present state of the science of "Pedagogy" on the banks of the Nile. We are told at home that "the schoolmaster is abroad,"—and "abroad" all *such* schoolmasters as those

* An Account of the Manners and Customs of the Modern Egyptians, written in Egypt during the years 1833, 34, and 35, partly from notes made during a former visit to that country, in the years 1825, 26, 27, and 28. By Edward William Lane. London, 1836. Charles Knight and Co. 2 vols. 8vo., pp. 428—427.

of Egypt may as well remain; here they are, at any rate, expected to be able to *read*,—an accomplishment in which it seems the birch-wielders of Egypt are palpably deficient. Under such a state of things, it need excite no wonder that the chapter which Mr. Lane devotes to "Literature and Science" is by no means cumbered with details; nor that the two which are required for the due exhibition of the "superstitions" of the people, are not only extensive, but full of all imaginable variety. And as, even these two are not sufficient, they are followed by another having for its subject a kind of medley of science and superstition—"Magic, Astronomy, and Alchemy." The pretensions of the Egyptian magicians to a knowledge of their art and mystery, are not by any means so contemptible as those of the schoolmasters. Mr. Lane relates, with great circumstantiality, certain feats of one of the tribe, to which he was an eye-witness, which would seem quite impossible to be effected by merely human agency,—very reasonably expressing a hope that his candour on the occasion will not have the effect of throwing a slur on the credibility of the details given in the portion of the book relating to more every-day and more comprehensible affairs. Such, for instance, as the following, vouched for, be it observed, by Mr. Lane, in his own proper person. He describes sundry incantations performed by a respectable professional magician, with the object of producing in the palm of a boy's hand, smeared over with ink, the image of any person, either dead or absent; such image being visible to the "seer" alone, who, in this case, was a boy taken promiscuously (and not by the magician) from a number of others. Passing over the requisitions of the rest of the company, we arrive at Mr. Lane's turn:—

"He (the magician) now addressed himself to me; and asked me if I wished the boy to see any person who was absent or dead. I named Lord Nelson; of whom the boy had evidently never heard, for it was with much difficulty that he pronounced the name, after several trials. The magician desired the boy to say to the Sooltan—'My master salutes thee, and desires thee to bring Lord Nelson: bring him before my eyes that I may see him speedily.' The boy then said so; and almost immediately added, 'A messenger is gone, and has returned, and brought a man dressed in a black* suit of European clothes: the man has lost his left arm.' He then paused for a moment or two, and looking more intently, and more closely, into the ink, said, 'No, he has not lost his left arm, but it is placed to his breast.' This correction made his description more striking than it would have been without it; since Lord Nelson generally had his empty sleeve attached to the breast of his coat; but it was the *right* arm that he had lost. Without saying that I suspected the boy had made a mistake, I asked the magician whether the objects appeared in the ink as if actually before the eyes, or as if in a glass, which makes the right appear left. He answered, that they appeared as if in a mirror. This rendered the boy's description faultless.

"The next person I called for was a native of Egypt, who has been for many years a resident in England, where he has adopted our dress; and who had been long confined to his bed by illness before I embarked for this country: I thought that his name, one not very uncommon in Egypt, might make the boy describe him incorrectly; though another boy, on the former visit of the magician, had described this person as wearing an European dress, like that in which I last saw him. In the present case the boy said, 'Here is a man brought on a kind of bier, and wrapped up in a sheet.' This description would suit, supposing the person in question to be still confined to his bed, or if he be dead. The boy described his face as covered; and was told to order that it should be uncovered. This he did, and then said, '*His* face is pale, and he has mustachios, but no beard;' which is correct.

"Several other persons were successively called for; but the boy's descriptions of them were imperfect, though not altogether incorrect. He represented each object as appearing less distinct than the preceding one, as if his sight were gradually becoming dim; he was a minute or more before he could give any account of the persons he professed to see towards the close of the performance; and the magician said it was useless to proceed with him. Another boy was then brought in, and the magic square, &c. made in his hand; but he could see nothing. The magician said he was too old."

It is a pity he was not able to accompany his wondrous tale with some probable explanation of the manner in which the imposition was effected; but this he leaves for "time and the curious to decypher," professing his own inability to

* Dark blue is called, by the modern Egyptians, *esswed*, which properly signifies black, and is therefore so translated here.

pluck out the heart of the mystery, and leaving the jugglers of Cairo in the very méridian of their glory. This is altogether a sad blot on his scutcheon as an observer whom nothing should escape.

The remaining portion of the first volume comprises, besides a chapter on the "Character of the Egyptians," a very ample picture of "Domestic Life," in three chapters; one appropriated to the higher, and one to the lower orders, while the middle one, for want of any "middle classes" to delineate, is occupied by a sketch of "the Harem." The second volume commences with a view of the state of the arts and manufactures in the land which claims, in the judgment of many of the learned, to be the land of their birth. It is not of a very flattering nature:—

"It is melancholy to compare the present state of Egypt with its ancient prosperity, when the variety, elegance, and exquisite finish displayed in its manufactures attracted the admiration of surrounding nations, and its inhabitants were in no need of foreign commerce to increase their wealth, or to add to their comforts. Antiquarian researches show us that, not only the Pharaohs and the priests and military chiefs, but also a great proportion of the agriculturists, and other private individuals, even in the age of Moses, and at a yet earlier period, passed a life of the most refined luxury, were clad in linen of the most delicate fabric, and reclined on couches and chairs which have served as models for the furniture of our modern saloons. Nature is as lavish of her favours as she was of old to the inhabitants of the valley of the Nile; but, for many centuries, they have ceased to enjoy the benefit of a steady Government. Each of their successive rulers, during this long lapse of time, considering the uncertain tenure of his power, has been almost wholly intent upon increasing his own wealth; and thus a large portion of the nation has gradually perished, and the remnant, in general, been reduced to a state of the most afflicting poverty.

"The male portion of the population of Egypt being scarcely greater than is sufficient for the cultivation of as much of the soil as is subject to the natural inundation, or easily irrigated by artificial means, the number of persons who devote themselves to manufactures in this country is comparatively very small; and as there are so few competitors, and, at present, few persons of wealth to encourage them, their works in general display but little skill.

"Painting and sculpture, as applied to the representation of living objects, are absolutely prohibited by the Mohhammadan religion; there are, however, some Moslims in Egypt who attempt the delineation of men, lions, camels, and other animals, flowers, boats, &c., particularly in (what they call) the decoration of a few shop-fronts, the doors of pilgrims' houses, &c.; though their performances would be surpassed by children of five or six years of age in our own country. The art in which the Egyptians most excel is architecture. The finest specimens of Arabian architecture are found in the Egyptian metropolis and its environs; and not only the mosques and other public buildings are remarkable for their grandeur and beauty, but many of the private dwellings, also, attract our admiration, especially by their interior structure and decorations. Yet this art has, of late years, much declined, like most others in this country; a new style of architecture, partly Oriental and partly European, and of a very plain description, being generally preferred. The wood-work of the doors, ceilings, and windows of the buildings in the older style, display considerable taste, of a peculiar kind; and so, also, do most of the Egyptian manufactures; though many of them are rather clumsy, or ill-finished. The turners of wood, whose chief occupation was that of making the lattice-work of windows, were very numerous, and their work was generally neater than it is at present; they have less employment now, as windows of modern houses are often made of glass. The turner, like most other artisans in Egypt, sits to his work. In the art of glass-making, for which Egypt was so much celebrated in ancient times, the modern inhabitants of the country possess but little skill: they have lost the art of manufacturing coloured glass for windows; but, for the construction of windows of this material they are still admired, though not so much as they were a few years ago, before the adoption of a new style of architecture diminished the demand for their work. Their pottery is generally of a rude kind; it mostly consists of porous bottles and jars, for cooling, as well as keeping, water. For their skill in the preparation of morocco leather, they are justly celebrated. The branches and leaves of the palm-tree they employ in a great variety of manufactures; of the former, they make seats, coops, chests, frames for beds, &c.—of the latter, baskets, panniers, mats, brooms, fly-whisks, and many other utensils. Of the fibres, also, that grow at the foot of the branches of the palm-tree, are made most of the ropes used in Egypt. The best mats (which are much used instead of carpets, particularly in summer) are made of rushes. Egypt has lost the celebrity which it enjoyed in ancient times for its fine linen; the linen, cotton, and woollen cloths, and the silks, now

woven in this country, are generally of coarse or poor qualities."—Vol. ii. p. 1.

Besides this general sketch, we have a more particular description of a branch of industry which has been more heard of in England than any other now practised in the land of the Nile, and has excited more curiosity, and, probably, more incredulity than many descriptions of *manufacture* much more difficult and more elaborate, although less striking to the million. We allude to the artificial hatching of eggs, which has been carried on in the north of Africa from time immemorial, but is not, perhaps, so well suited to our variable climate, if we may judge, at least, from the circumstance that the speculator who, some few years ago, attracted so large a share of public attention to his patent system of hatching chickens by steam, has long since given up his establishment, and left his business to those natural patentees, the *hens* of the United Kingdom. Mr. Lane indulges his readers with a somewhat full account of the process used by the Egyptians, which we make no apology for transferring to our pages, since the *Mechanics' Magazine* is expected to record all improvements on the old-fashioned methods of producing any "manufactured article."

"The Egyptians have long been famous for the art of hatching fowls' eggs by artificial heat. This practice, though obscurely described by ancient authors, appears to have been common in Egypt in very remote times. The building in which the process is performed is called, in Lower Egypt, *ma'amal el-firá'kh*, and in Upper Egypt *ma'amal el-furroo'g*; in the former division of the country there are more than a hundred such establishments—and in the latter, more than half that number. The proprietors pay a tax to the Government. The *ma'amal* is constructed of burnt or sun-dried bricks; and consists of two parallel rows of small chambers and ovens, divided by a narrow, vaulted passage. Each chamber is about nine or ten feet long, eight feet wide, and five or six feet high; and has above it a vaulted oven, of the same size, or rather less in height. The former communicates with the passage by an aperture large enough for a man to enter; and with its oven by a similar aperture: the ovens, also, of the same row communicate with each other; and each has an aperture in its vault (for the escape of the smoke), which is opened only occasionally; the passage, too, has several such apertures in its vaulted roof. The eggs are placed upon mats, or straw, and one tier, above another, usually to the number of three tiers, in the small chambers; and burning *gel'leh* (a fuel composed of the dung of animals, mixed with chopped straw, and made into the form of round, flat cakes) is placed upon the floor of the ovens above. The entrance of the *ma'amal* is well closed. Before it are two or three small chambers—for the attendant, and the fuel, and the chickens when newly hatched. The operation is performed only during two or three months in the year—in the spring; earliest in the most southern parts of the country. Each *ma'amal*, in general, contains from twelve to twenty-four chambers for eggs, and receives about 150,000 eggs during the annual period of its continuing open; one quarter or a third of which number generally fail. The peasants of the neighbourhood supply the eggs; the attendant of the *ma'amal* examines them, and afterwards usually gives one chicken for every two eggs that he has received. In general, only half the number of chambers are used for the first ten days; and fires are lighted only in the ovens above these. On the eleventh day these fires are put out, and others are lighted in the other ovens, and fresh eggs placed in the chambers below these last. On the following day, some of the eggs in the former chambers are removed, and placed on the floor of the ovens above, where the fires have been extinguished. The general heat maintained during the process is from 106° to 109° of Fahrenheit's thermometer. The manager, having been accustomed to the art from his youth, knows, from his long experience, the exact temperature that is required for the success of the operation, without having any instrument, like our thermometer, to guide him. On the twentieth day, some of the eggs first put in are hatched; but most on the twenty-first day, that is, after the same period is required in the case of natural incubation. The weaker of the chickens are placed in the passage; the rest, in the innermost of the interior apartments, where they remain a day or two before they are given to the persons to whom they are due. When the eggs first placed have been hatched, and the second supply half hatched, the chambers in which the former were placed, and which are now vacant, receive the third supply; and, in this manner, when the second supply is hatched, a fourth is introduced in their place. I have not found that the fowls produced in this manner are inferior in point of flavour, or in other respects, to those produced from the egg by incubation. The fowls and their eggs in Egypt are, in both cases, and with respect to size and flavour, very inferior to those in this country. In one of the Egyptian newspapers published by order of the Government, (this daily for the

18th of Rumadán, 1246 (or the 5th of March, 1831, of our era), I find the following statement:—

	L. Egypt.	Up. Egypt
Number of establishments for the hatching of fowls' eggs in the present year.....	105	59
Number of eggs used.....	19,385,600	6,878,900
Number spoiled.....	6,255,867	2,529,660
Number hatched.....	13,069,733	4,349,240

Vol. ii. p. 4."

What a pity that no machine has yet been invented to lay, as well as hatch the eggs! Till that has been done, the artificial process is but half complete.

With the exception of the opening chapter, Mr. Lane's second volume is almost wholly devoted to the festivities and amusements of the modern Egyptians, on which he dilates at very considerable length, and with, apparently, a perfect knowledge of the subject; on the head "Public Recitation of Romances" he is particularly diffuse—and the chapters on the "Public Religious Festivals of the Mahometan Year" are, as might be expected, long and full of matter. These two form the "leading articles," and are well supported by the chapters on Private Festivities, Games, Music, Public Dancers, and the Bath; while Superstition claims another notice in that relating to "Serpent-Charmers, and Performers of Tricks of Legerdemain." Any picture of Oriental manners would be imperfect without a pretty considerable view of the "Use of Tobacco, Coffee, Hemp, and Opium;" and "Funeral Rites" most appropriately wind-up the whole.

We were rather surprised to find Mr. Lane adhering so very strictly to the letter of his title-page, as not to allow himself to give even a short outline of the interesting proceedings of the present Pacha, which bid fair to change the whole face of society in his dominions. A very few pages are, indeed, devoted to his "Innovations" in the Supplement, but this is all. We had hoped for a somewhat lengthened account of his introduction of the learning, the arts, and the inventions of Modern Europe, and the effects it has produced upon his subjects, or seemed likely to produce. Mr. Lane, however, eschews the Modern History of Egypt with as much circumspection as the Ancient, and pays no more heed to the canals, the railways, and the other public works of the Pacha, than to the temples and pyramids, and ruined cities of his predecessors by some thousands of years. All this, we suppose, is yet to come, in the other works whose appearance is promised in the preface. It might have been as well, nevertheless, to have touched even lightly upon these subjects; it would have connected a sort of European interest with the book. Besides, we have a kind of right to be informed whether any, and what, change has been produced in the "Manners and Customs of the Modern Egyptians" by the "more extended commercial relations since the Pacha's cultivation of the cotton trade, by the return of the young Egyptians sent by him to be educated in Europe, by the introduction of English engineers and French physicians among the haughty Beys of the country, and a host of other innovating measures of Mahomet Ali."

GAS-STOVES.

Sir,—Your correspondent, Evander, having requested some information respecting gas-stoves, and the cause of some peculiar phenomena which take place by the combustion of coal-gas, I am happy to afford him the information he desires.

The heat produced by these stoves is proportional to the quantity of *oxygen*, abstracted from the atmosphere, which enters by combustion into combination with the *carburetted hydrogen*, or coal-gas; the quantity of oxygen required for its perfect combustion varying with he quality of the ga. On an average of quality of the common carburetted hydrogen, every cubic foot which is burnt, unites with two cubic feet of oxygen; and the product of this combination is 2·6 *cubic inches* of water, and 1 *cubic foot* of carbonic acid gas: the weight of these being exactly equal to that of the oxygen and carburetted hydrogen consumed. For of the two constituents of the carburetted hydrogen, the one (*hydrogen*) unites with one half the oxygen abstracted from the atmosphere, and forms water; and the other (*carbon*) unites with the remainder of the oxygen, and forms carbonic acid gas.

By a stove which burns 15 cubic feet of carburetted hydrogen gas per hour, there will be formed 39 cubic inches of water (nearly a pint and a quarter), and 15 cubic feet of carbonic acid gas. The

is no difficulty, then, in accounting for the fact which your correspondent states, "that the windows of a room where such a stove is used are covered with moisture:" for if the stove be used for fourteen hours a day, it will in that time form just two gallons of water, which must all be deposited on the windows and walls of the room, or on any other cold surfaces. There are no means of preventing this formation of water, as it has no connexion whatever with the nature of the materials of the stove; for, whenever hydrogen gas is burned with oxygen, water is necessarily formed.

When a flue-pipe is attached to a stove of this description, to carry off the impure air, there is a very great loss of heat: for the combination of the hydrogen and oxygen takes place at so high a temperature, that the product assumes first the state of *steam*; and if this steam escapes uncondensed the whole of its *latent* heat, and a considerable part of the *sensible* heat, must be lost, as regards any beneficial effect in warming the room. If the whole of the two gallons of water, which we have shown above to be formed by a stove of this kind, per day, escapes uncondensed, as much heat will be lost as would have raised 111,000 cubic feet of air 10°. Though, in point of fact, *the whole* of the steam cannot under any circumstances escape uncondensed, this calculation will show how much heat must be lost, by having a flue-pipe to carry off the products of the combustion, which would therefore render the stove much more expensive to burn.

In answer to your correspondent's inquiry, whether these stoves would render the air unwholesome to breathe, I will endeavour to point out some of the physiological effects which result from their use.

All persons are aware, that air when expired from the lungs is loaded with a considerable quantity of vapour; and it is this capability of the air to absorb moisture, which prevents its accumulation on the lungs, to any unnatural extent. But if the air when taken into the lungs is already saturated with vapour, it is evident that it cannot carry off the full quantity from the lungs at its expiration; though as its temperature is then considerably higher, it will always receive an additional quantity in its passage, as the capacity of air for absorbing moisture increases with its elevation of temperature. Without going into any minute calculations on this head, it may be stated that the average quantity of vapour which ought to pass off in pulmonary transpiration, is about three grains per minute; but that by breathing air at a temperature of about 60°, already saturated with vapour, this quantity would be reduced to about one half; which being unnatural, cannot be otherwise than unhealthy: it would, in fact, induce various pulmonary complaints, and not improbably end in consumption.

But this is not the only effect produced by these stoves. We have already seen that a large quantity of carbonic acid gas is produced. The destructive effects of this gas on the human frame are well known: the choke-damp of mines and wells is identical with it, the dangerous effects of which require no comment. In addition to this, when the *oxygen* is abstracted from the air to support the combustion of the coal-gas, as already described, a large quantity of *nitrogen* is set free, and escapes and mixes with the air of the room. This gas likewise is peculiarly inimical to animal life; and the quantity amounts to four times that of the oxygen consumed. In such a stove as we have calculated above, there would, therefore, be 15 cubic feet of carbonic acid gas, and 120 cubic feet of nitrogen, per hour, which escapes from the stove, and mixes with the atmosphere of the room. It will easily be perceived, then, that unless a very rapid ventilation is provided in a room where a stove of this kind is used, the air must soon become extremely unwholesome to breathe, and produce effects inimical to health.

As to the expense of burning one of these stoves, I believe that no exact information can be given, because it depends upon the diameter and height of the jets; and no two stoves will burn exactly the same, and even the same stove will vary at different times. The average of small sized stoves I believe to be from 12 to 15 cubic feet of gas per hour, which would, if it were a close stove, afford sufficient heat for a small shop or counting-house. The stove will burn with the greatest economy when the gas escapes with the *least* velocity; as the combustion is then more perfect: for otherwise a portion of it escapes unburnt, and therefore without producing any effect. The velocity of escape may be diminished, by increasing

the number of jets and diminishing their size, at the same time reducing the height of the flame. Under any circumstances, however, it will be found much more expensive than a stove heated by coal.

Yours obediently,

C. H.

AERIAL NAVIGATION.

Sir,—More has been written in your valuable journal on the subject of aerostation, within the last few months, than during any equal period of time previous. The construction of Green's new and powerful machine, and the astonishing and unequalled trips which have been made with it, seem to have been the chief means of directing public attention more fully to the subject: and though it must be confessed, that little has yet been done towards improving the art, the time seems now come when the scientific world looks upon the subject with very different emotions from what it was wont to do—to endeavour, if possible, to turn to some useful account, what has till now been almost wholly employed to gratify public curiosity. To this end the papers which have appeared in your magazine have most materially assisted; every new fact or suggestion gives fresh interest to the subject; and therefore, every idea bearing upon the subject must be valuable. The subject may be barren, and the soil unfruitful, but by careful cultivation and management, some good fruit must be produced.

Notwithstanding the startling and sudden announcements of Mr. Baddeley and Signor Andervotti, I am inclined to believe that guiding, or propelling balloons, is neither so easy, nor of that simple accomplishment as one might infer from their statements. Nevertheless, from the general information and good sense, which is generally displayed in Mr. Baddeley's communications, I think we may safely look forward to his invention with interest. We may be well assured he has not raised the public expectation for the mere purpose of disappointing it? While here, I cannot help pointing Mr. B. to one valuable circumstance in his invention, which he may have overlooked. That is "the upward or downward motion, which can be given without varying the quantity of gas or ballast." Now the ultimate effect of this must be a diminution in the size of the balloon (a consummation greatly to be wished), for we shall only want just sufficient gas to raise us from the ground, and we can then, by new power, elevate ourselves to any height we please; we have only to cease in our exertions and we descend, again apply the power and we rise alternately.

I think it is very generally admitted, that nothing can be done, as long as the present shape of balloon is continued. Whilst that is the case the resistance would increase to such an enormous degree, as to set at defiance the power attainable by manual labour. Mr. Mackintosh in a recent Number, referred your readers generally, to a letter of his in No. 637 of your Magazine, and on that letter I wish to make a few observations.

Taking as correct the result of his calculation, that one cubic foot of hydrogen gas has a buoyant power of half an ounce, I will pass to the conclusion he has there jumped at, relative to the total resistance at 30 ft. per second. A cube, the side being 27ft., would present an area of surface equal to 729 square feet; and consequently, the resistance at two lbs. per foot, would be 1458 lbs. instead of 54 lbs. This difference, I imagine, would put a new feature on the subject. How Mr. M. could make so great a mistake in so simple a calculation, seems difficult to imagine. This calculation, of itself, is sufficient to show the difficulty attending any mode of propelling, and we must rest our hopes for improvement on a different construction of balloon. What could wings do against such a force? what oars? or what paddle-wheels? to say nothing of their clumsiness; and we may rest assured, that if ever a mode of steering or propelling is found out, it will be by no such *unwieldy means*.

We now come to the grand idea of employing birds to move balloons, by yoking together whole flights of eagles, and bringing them under control by curb and rein. This must be considered as one of those extravaganzas which are sometimes perpetrated by clever men. The subject, to me, appears at once so absurd, as not to merit one moment's consideration; and the following simple calculation may, perhaps, be the means of making a similar

impression on others of your readers. Taking the total resistance at 1458 lbs. as before stated, and assuming with Mr. M. that one eagle can draw 8 lbs., it appears that no less a number than 182 would be required! A trifling number, perhaps, in Mr. M.'s eye. This estimate is founded on the resistance encountered by a balloon in its present shape; but supposing we could reduce that resistance three-fourths, it does not appear to reduce the absurdity of the project in *any* proportion.

Mr. Mackintosh, by this letter, will see of how much importance it is to be correct in our calculations, when the result of those calculations is made the basis on which our after reasonings are built.

Mr. Ogle's suggestion for employing gas as ballast, could never be adopted till we have some more easy method by which the compression of gasses could be effected, as he ought to be aware that every additional atmosphere would give an increasing pressure of 15 lbs. per square inch; and, consequently, it would require vessels of enormous strength to contain sufficient gas to be of any avail.

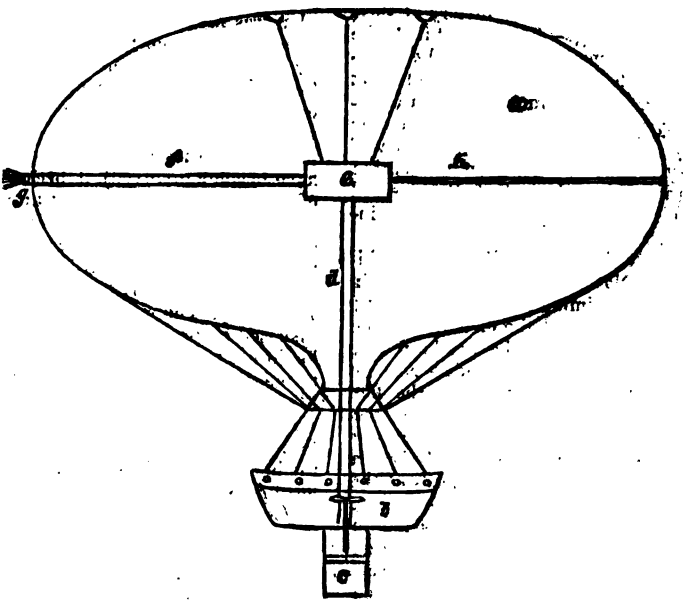
Mr. Weekes, in the description of a universal eudiometer invented by him, and described in No. 565 of the *Mechanics' Magazine*, has some beautiful and striking observations on this subject:—

"The condensation of gaseous matter, and its consequent conversion thereby to the liquid, and, in some instances, to the solid state, furnishes materials for the basis on which future genius and experience will erect a superstructure of unprecedented magnificence and importance to chemical science, and the mechanical arts of the world. A thousand projects which would now be ridiculed as the day-dreams of the visionary and enthusiast, will find in the successful production of liquid and solid matter from aeriform bodies, more than the ample means of realisation. What, for example, should we think of the adventurous aeronaut who now requires the production of many thousand feet of hydrogen to render buoyant his etherial car, and waft him to the vast altitudes he is capable of thus attaining in the regions of the atmosphere, when he should propose, instead of resorting to the manufacture of coal-gas, or the slow decomposition of water, for the agency of his flight, to avail himself of the simple expedient of removing compression from the contents of a strong vessel of some cubic inches capacity, preserved at a low temperature, and in the space of a few minutes dilate his splendid balloon by the rapid transition of solid matter to the gaseous form, and in the next instant spring majestically to the skies!"

When we look back through a long lapse of years, since the discovery of balloons to the present time, and see the little progresss that has been made, we may almost feel ashamed. Man, spurning the ground on which he treads, has found means by which he can elevate himself to heights, emulating the soaring of the eagle. He can descend at will, and re-ascend as pleasure or convenience dictate. But though possessed with such power, yet he has not found equal means whereby the vast machine can be brought properly under his control; but remains suspended in mid-air, between heaven and earth, wafted hither and thither by the caprice of the gentlest wind, unable to steer his course, and unable to alter his horizontal position. Humiliating thought! We see the eagle possessed of power, not merely sufficient to raise its ponderous body from the earth, but also to give it a velocity outstripping the wings of the wind. And is not man on an equal footing? If nature has forbid him the use of wings to support his body in the air, that defect is amply remedied by mechanical aid. He can command a power sufficient for his easy support, and thus leave him his whole physical force to direct his course; whereas a bird has not only to direct his course, but to support its whole body with its wings.

I will now sugg simple mode of propelling balloons, which appears at once so effective, when compared with previous attempts, so simple, and so inexpensive, as to entitle it to serious consideration; and though its power cannot be sufficient to force a balloon against a wind of thirty feet per second, yet I shall be satisfied if it will produce a lower velocity. At all events, I shall be quite content if I can point out a path, which may, perhaps, be easily and successfully trodden by others.

The following sketch will make the description better understood. It is a longitudinal section through the balloon and car.



Suppose *a* to represent the balloon; *b*, the car; *c*, a light but powerful air compressor, as large as a man can conveniently work (perhaps a fan would be preferable); *d*, a flexible pipe proceeding from the compressor; *e*, a small air-chamber; *f*, a flexible pipe, with a metal termination at *g*; *h*, a slight rod of wood. The *modus operandi* will now be easily perceived. Air being powerfully forced into *e* by the compressor *c*, will escape by the pipe *f*, and a motion in the opposite direction must be the immediate consequence, varying in velocity as the force exerted at the pump *c*. The effect would be so certain, and the means of applying it so simple and easy, as to leave comparison with any method already known out of the question. It would want no complication of rudder, as a small lateral pipe would effect a revolving motion, and thus keep the main jet in the proper direction, and the whole of the apparatus would take up the least possible room; whilst by having the compressor to act during the up-and-down stroke, a continued stream of air would be produced. The truth of this statement may be proved in the most easy manner, by simply mounting a small pasteboard air-chamber, on four small wheels, and blowing into it by a very flexible tube. It will be found that with such imperfect means an astonishing velocity will be obtained.

I must now close this letter, which has extended to an unpardonable length, by leaving the suggestion in the hands of your intelligent readers. I am sure they must acknowledge its simplicity, its compactness, its little cost, and its effectiveness, when compared with any of the existing methods, which have uniformly been characterised as clumsy and ineffective. I am persuaded that it deserves a trial, and that in *calm weather* it would do that which no other means has yet accomplished.

I am, Sir, truly yours,

JOHN LAKE.

Guyton, Jan. 12, 1837.

THE NATIONAL GALLERY.

How well acquainted the officers of Government are with the history of their own proceedings—how carefully the House of Commons consults the documents which it orders to be printed, at the public expense, for its use and benefit—may be estimated from the singular history of the erection of the National Gallery, which manifests an inattention and ignorance on the part of all connected with it which really border on the incredible.

For some time Mr. Wilkins, the architect of the National Gallery, has been in the habit of claiming the merit of having originally suggested the idea of erecting it on its present site—the northern side of Trafalgar-square. He made a positive statement to that effect before the late Committee of the House of Commons respecting the Arts of Design. "Four plans," he said, "were laid before a Committee appointed by the Lords of the Treasury—two by Mr. Nash, one by Mr. Cockerell, and my own." This led to an inquiry from Dr. Bowring (Question 1392). "And the number of architects who were competitors were (*sic*) confined to those three?"—"Yes," is the reply; "they were hardly competitors, I do not know whether I ought to call them competitors; plans had been presented by Mr. Nash and Mr. Cockerell, but the fact is, that the suggestion of erecting a building for this purpose *originated with me;* whether that was a ground of preference or not, I do not know, but I wish to state that. The site was about to be converted into shops, and seeing a very magnificent site, *I* took the liberty of calling at Lord Dover's and Lord Aberdeen's, and suggesting *there would be the site* for a National Gallery if one was to be erected." "Did you make a written representation on the subject?" continues the questioner. "Yes," replies Mr. Wilkins, "and Lord Dover communicated with Lord Grey, in consequence of which I had to wait on Lord Grey." From this statement we observe, that the suggestion was made when Lord Grey was in power—therefore not before 1830—and at a time when the site appeared magnificent—therefore after the clearance had been made for Trafalgar-square. As it happens, however, that clearance was made, and Trafalgar-square was formed, for the express purpose of building the National Gallery where the National Gallery now stands, the originator of the plan was Mr. Nash—it met with the patronage of George IV.—it was proposed by the Commissioners of Woods and Forests—it was sanctioned by the House of Commons—and (it might be added, were it not for the Cimmerian darkness in which parties subsequently appear to have become involved) it became matter of public notoriety in the year 1826, or four years at least before Mr. Wilkins started the bran-new idea, as he imagined, to that trio of very well-informed individuals, Lord Dover, Lord Aberdeen, and Lord Grey. The reader, perhaps, may be disposed to be incredulous about this, if he do not happen to have paid attention to the subject himself, especially as when Mr. Wilkins made his statement there was no one found among the Committee to hint a suspicion of his perfect right to the honour he laid claim to. But by referring to the 14th volume of the House of Commons' Reports for 1826, which contains the Fifth Triennial Report of the Commissioners of Woods, Forests, and Land Revenues, he will find in Appendix, No. 23, plate 3, a "Plan of the Proposed Improvements at Charing-cross, St. Martin's-lane, and Entrance to the Strand," in which an edifice standing on the north side of the then projected square, since made and named Trafalgar, is very legibly labelled, "NATIONAL GALLERY OF PAINTING AND SCULPTURE." In front of it facing towards Whitehall appears another building, intended to be an exact copy of the Parthenon at Athens, and appropriated to the Royal Academy, who have since, to the dissatisfaction of the Committee before which Mr. Wilkins gave evidence, been billeted in the National Gallery itself.

The claim of Mr. Wilkins is, therefore, "baseless as a dream," and his story only adds another to the numerous instances of the singular ignorance of our artists and amateurs, respecting what is going on around them in the very sphere with which they ought to be best acquainted. For instance, from the evidence of Sir Francis Chantrey, of Mr. Hawkins, and others, respecting the mode of engraving medals by machinery, this, at least, appears evident, that till a Frenchman came from Paris to solicit support for the im-

perfect method of attaining the object in practice there, they had never heard of or attended to the ingenious contrivance by which the art had been brought to perfection by one of their own countrymen "under their own noses." The palm must, however, be allowed to remain with Lord Dover, Lord Aberdeen, Lord Grey, the House of Commons, the Lords of the Treasury, and Mr. Wilkins.

REMARKS ON MR. SIEVIER'S PATENTS FOR INDIA-RUBBER MANUFACTURE.

Sir,—Your readers and the public are greatly indebted to you, for laying before them the patented inventions which are to form the basis of the London Caoutchouc Company. On glancing over the objects to which Mr. Sievier has directed his attention, I observe, that, in the first of his patents, cordage is by far the most prominent, as an article of extensive consumption. It does not appear that the presumed improvement, arising from the introduction of caoutchouc, extends beyond the mere giving to cables, ropes, and lines, the property of extending and contracting; which property, it seems, would for some purposes be desirable. Is Mr. Sievier aware that a patent was long since taken out for introducing caoutchouc into these very articles, and that they were not brought into use, and, in fact, could not be used, on account of the rigidity contracted by caoutchouc when exposed to cold? Every body knows that the most flexible piece of caoutchouc that can be produced will become as hard, and as unpliant, as a piece of ash timber of the same dimensions, in one cold night. If Mr. Sievier has a remedy against this decisive objection, he has not stated it in his patent, which he should have done if he knew of any. It is easy to see that a cable, for instance, containing a sufficient quantity of caoutchouc to make it elastic at a medium temperature, would in a single night of frost become so inflexibly stiff, that the united efforts of a whole ship's crew would not be able to uncoil it. Let us hope that Mr. Sievier has some clear and explicit explanation to give the public on this point; doubtless your pages will be open to him. The other part of this patent relative to the making elastic, carpet bags or purses, at the mouth, by the introduction of caoutchouc, is an old patented invention, and of little value.

The second patent is for introducing caoutchouc as an elastic into stockings and other articles of dress. A similar contrivance was patented sixteen or seventeen years ago, but it was found that frequent washing in warm water and soap, soon impaired the elasticity of the caoutchouc; and the application of it at that time went out of use except for gloves, in which it has been used ever since.

The next object of this patent, is the formation of an elastic cloth, with or without a nap, and elastic in both directions. Where can we purchase this cloth? And to what uses has it been applied?

The last patent was taken out about a year ago for dissolving caoutchouc in liquor ammonia: of what value it may be, I cannot tell. I put some caoutchouc, cut very thin, into "liquor ammonia" "some months" ago, and the only observable effect is, that the surfaces of the thin slices are softened, and not at all disposed again to become hard, or dry; but beyond this no perceptible effect has been produced. Perhaps Mr. Sievier will inform us, where this solution of caoutchouc, as well as some of the "solid masses of any form" of which he speaks of, are to be purchased, or seen; as until I see these specimens, I for one shall continue to think, that there is some mistake about this solution in "liquor ammonia," and the producing any degree of consistency by increasing or diminishing the quantity of water, &c. Many modes of dissolving caoutchouc have been announced, which, when tried, have proved useless; either on account of its never drying, or returning to its original state by evaporation; or, if it did, soon becoming soft again. What prospects the company may have in relation to their mercantile operations, I leave to the examination of others. I look to the patents which you say "it appears the company are to purchase at a considerable expense," which is, I think, in the first instance, the most important part of the business.

I am, Sir,
Your obedient servant,
MAINPOINTS.

VENTILATION OF ROOMS.

Sir,—I resume my observations on the subject of ventilating rooms. It is a matter of so much interest to people in general, that I think it will induce you

to afford me space for the insertion of these few suggestions. The question is, whether a stagnant body of unwholesome atmosphere, which we generally breathe in rooms, is not to be removed, and give place to a fresh supply of that which is not only more pure, but more healthy. I assert that it can be easily done, and I support that assertion by proposing the following remedies as means for accomplishing the same. If I speak of rooms about to be built, I shall say, introduce into the chimney the outlet which I alluded to in my last letter, and also let there be two or three openings of the same description in the *ceiling*, which shall communicate also with the chimney or the front of the house. I am aware that these openings in the ceiling *have* been introduced in some instances, but upon a scale so extremely small, that the idea of their being of the slightest use in causing a ventilation, is perfectly absurd. I have lately seen two instances in rooms where large numbers are in the habit of assembling; the principle is quite correct, but it is rendered necessary by the outlet being so absurdly small, as to afford very little passage for the imprisoned heat. These openings into the ceiling might be formed of such bold designs, and so arranged, that they would contribute as much to the beauty and style of the room, as the pattern upon the carpet, or any other part which is intended to be ornamental.

If I speak of rooms already built, I beg to propose another remedy which can be easily adopted, and that at little trouble and little cost. There is a species of manufacture, if I may so call it, introduced within the last few years, for the use of man, which, I believe, is generally known by the name of wire-gauze; this wire-gauze heretofore, I believe, has been applied to no other useful purpose than that of being affixed to the lower part of windows, for the purpose of excluding the view of the public from those rooms where parties wish to sit to see the "stir of the great Babel and not feel the crowd." In other words, they are very effective in ensuring protection from the public gaze, whilst they scarcely interfere at all with the view from the interior. So far the purpose is answered, but I want to extend its utility beyond this point. I want to use it as a medium by which fresh air may be admitted into a room without inconvenience, and thus it should be done.

Let the upper half of each of two windows in a room be lowered, and let a wire-gauze blind be made to fit in the open space, the consequence would be, that through these blinds the air would be admitted freely without the slightest inconvenience to any one who might be in the room; in fact, so little could even the most delicate be affected by it, that the hand, if held at the distance of three or four inches from the blind, will not be sensible of the slightest current, so completely is it broken by passing through, what Dr. Johnson calls the interstices of the intersections. I propose to have the blinds inserted in the *upper* part of the window, because I am aware that many persons would imagine, that if they were in the lower half they would be objectionable from their admitting too much air; but the fact really is not so, for any one might sit for hours close by them without the least danger or possibility of catching cold. If, however, they are affixed in the upper half, any apprehension of this being the case is utterly groundless. When the wire-gauze is applied to this purpose, it is not necessary to have it of that fine character I observe it generally bears, the interstices might be farther apart, and the quantity of air admitted in consequence would, of course, be much greater. In the coldest weather the windows in any room might be kept open with these blinds fixed up; for if it be asserted that the cold would be felt too severely, my argument as to the act of ventilation is instantly supported, for it is thereby proved that a body of fresh air is introduced; and to prevent the same being at all inconvenient, you have only to close the windows to such an extent as to reduce the supply, and bring it within a habitable temperature. Any room having these blinds, and the opening into the chimney, which I have before referred to, would be unable to contain even for half an hour the rising volumes of cloudy exhalations puffed forth with vigour from one dozen of Cabana's best Havannah bristling from the mouths of confirmed smokers.

Now that I am on the subject of the wire-gauze, I may be allowed to express my surprise that it has not yet been used in gentlemen's carriages and stage-coaches. Is not every one aware of the

extreme danger of having the window of a carriage down to those who sit on the back seat?—it is not only dangerous, but unpleasant, to sit exposed for hours to such a body of cold air coming through a contracted space;—at night, too, four persons are cooped up in a mail-coach, breathing such an atmosphere as would destroy life, unless by the periodical opening of the window. Let these wire-gauze blinds be added to each window, and in cold or heat, in winter or summer, through them will you breathe as pure and wholesome an atmosphere as those enjoy who sit on the outside. The indisposition which persons feel after travelling inside all night, and indeed during the day, in cold weather, arises principally from the impure air which they have been breathing during their journey. If these blinds are affixed on each side, an abundant supply of air is admitted, and in a way to be neither unpleasant or attended with any danger, which it always is to those who sit on the back seat when admitted through the open window.

Every one must be aware of the benefits arising from a thorough ventilation in every house, and in every room in every house, but more particularly in hospitals and in houses where the poor congregate and are maintained in great numbers; and, in fact, in all places where large bodies of the population are brought in contact. If, therefore, any observations of mine should be the means of effecting this, or inducing others to turn their attention to the subject, and thereby effecting it, my purpose will be fully answered, and I shall rest satisfied at having contributed towards the establishment of a system which perhaps had remained otherwise neglected, and one which I am confident will not only contribute to increase the personal comfort, but also improve the general health of the great mass of the population.

I am, Sir, yours, &c.

M. C.

MR. MACKINTOSH'S PERPETUAL MOTION —NAUTILUS IN EXPLANATION.

"Now, then, could Mr. Mackintosh, his magnet being powerful enough to suspend his bullet, and thereby *nullify its gravity*, still expect that the said gravity would exert its power in causing the descent of his wheel."—NAUTILUS, Dec. 11, p. 223.

"It must be plain to every one, that gravity, the very power which was intended to give motion to the wheel, is completely neutralised by the power of the magnet."—TREBOR VALENTINE, Jan. 28, p. 315.

"I know that the wheel will not, and I know also the reason why it will not, go; but Nautilus has not yet made that discovery"——"his attempt (to do so) is a complete failure."—MACKINTOSH'S REPLY TO NAUTILUS, Jan. 14, p. 282.

Sir,—I trouble you with the above quoted short extracts to show Mr. Mackintosh that I am not singular in my opinion of the true reason of his machine being *no go*. Perhaps, having allowed sufficient time for other competitors in the solution of this great problem to have come forward if they would, Mr. Mackintosh will now enlighten your readers by revealing *his* explanation, which he declares he has hitherto kept in *imo pectore*, for the purpose of exciting a laudable emulation amongst your ingenious correspondents. At the same time, it will be only fair that he should demonstrate that my explanation of the no-going propensity of his wheel, *is* the great failure he asserts it to be.

One word as to the previous portion of his reply; touching the moon's rotation, he says, "I readily grant the correctness of his (Nautilus's) views with respect to the *imaginary axis*." What is to be inferred from this, but that Mr. Mackintosh supposes that the moon's axis is *not imaginary*, but real and *bonâ fide*? in fact, that there is something like a goodly roasting-spit thrust through and through, with perhaps a protruding peg at each end for the man in the moon to hang his hat upon. As for the assertion, that Kinclaven has been knocked on the head with the lump of lead on the arm of the fly-wheel, I leave it to himself to deny it; I can find no marks of the dent in any of his letters.

I remain, Mr. Editor,
Your obedient servant,
NAUTILUS.

Feb. 5, 1827.

AN ARITHMETICAL QUESTION.

The late Dr. Hamilton, of Aberdeen, in his excellent system of arithmetic, asserts, that the interest of 1000*l*., at the

rate of 5 per cent. per annum, is only 24*l.* 13s. 9¾d. for half a year. How can this be, when the simple interest for the same sum, at the same rate and time, is 25*l.* Perhaps some of your algebraical correspondents will be so kind as to explain this (to me) seeming paradox.

A TOWN TEACHER.

TWO GEOMETRICAL QUESTIONS.

By A Cambridge Student.

Problem 1st. Given the base the vertical angle, and the ratio of the segments of the straight line, as divided by the centre of the inscribed circle, and drawn from the vertical angle to the base. To construct the plane triangle.

Problem 2nd. The two first conditions of the above problem being the same, and the rectangle of the sides being given—to construct the triangle; upon principles not extending beyond the Third Book of Euclid.

LIST OF IRISH PATENTS, GRANTED IN THE MONTH OF JANUARY, 1837.*

John Gordon Campbell, merchant, and John Gibson, throwster, both of Glasgow, for a new or improved process or manufacture of silk, and silk in combination with certain other fibrous substances. Jan. 21.

John Wilde, merchant, and Joseph Whitworth, engineer, both of Manchester, for certain machinery for effecting the operation called knitting, and producing a fabric similar to that of knitted stockings; partly communicated by a foreigner. Jan. 28.

NOTES AND NOTICES.

A Good Site for a Hero.—The statue of the Duke of Wellington, for which upwards of 7000*l.* have been raised, chiefly among City magnates, it is decided shall be placed between the Bank and the Mansion-House, at the entrance of the street (King William-street) leading to the bridge, for his share in promoting the erection of which the statue is (ostensibly at least) to be raised to his Grace. It will stand, most probably, on the site of "the great *Globe* itself" (*i. e.* the Globe Insurance-office), which, now that Princes-street approaches towards completion, certainly stands sadly in the way, and calls loudly for removal as little better than a common nuisance!

An expected Arrival.—Orders have been received in Egypt from the Trustees of the British Museum for the immediate removal to London of the fine colossal statue of Sesostris, which, ages since, ornamented the centre of the city of Memphis.

Taylor's Scientific Memoirs.—We are sorry to find, from the Advertisement prefixed to the Third Part of this work, which has just appeared, that it has not attained to a sale sufficient to remunerate its spirited projector, and ensure its permanent existence. It will be a sad slur on the scientific world if a periodical so much called for, and even so essentially required, be suffered to fall to the ground for want of patronage, especially as Mr. Taylor looks for no pecuniary reward for his own valuable services, but expresses his determination to continue his labours, if only a sufficient number can be sold barely to defray the unavoidable expenses of publication. By the way, we may as well remark, that this Third Number forms a part of Vol. I., which will include four Numbers, instead of two, as stated in our 704th No.

"The Air hath Bubbles."—Air-ballooning is likely to be turned to practical use at last. The "Aeronautical Association, for applying Aerostation to the Purposes of Geographical Survey," is already in operation, and has progressed so far as to open an office, to receive applications for the "four thousand shares, of two pounds each," which are to compose the capital of the Company, "one half to be paid on applying for shares!" *As soon* as the subscription list is filled, the Association will commence its labours by taking a minute aerial survey of the interior of Africa, for which purpose aerostation presents such tempting facilities, especially with the assistance of the trade winds, blowing constantly in one direction, so as to render the steering of the balloon a matter of infinite ease,—or rather to do away with the necessity of steering at all! This is certainly one of the most *promising* speculations in the market, but we are not aware that the shares of the Association are yet at any very high premium.

Novelty at a Discount.—The New Smithfield at Islington has now given up all competition with its too firmly-established rival, and the "public-spirited projector," thoroughly disappointed in his hopes of realising a fortune out of the "tolls" so specially secured to him by the Act of Parliament, on whose omnipotence he relied, has offered the concern (at no very high price, it may be presumed, *under existing circumstances,*) to the Common Council of the City of London.

Mr. Collier's Boilers.—Sir, In reply to a note in your last Number, I beg to state, that not having the slightest wish to be considered as *personally* opposed to Mr. Collier, I withhold my name. The observation I made in your publication was on public grounds, I therefore expected Mr. Collier would as publicly answer it.—I am, &c. T—— H——. Feb. 13, 1837.

A correspondent wishes to purchase a working model of a condensing steam-engine. Particulars to be left with our publisher.

Mr. Nolte's "Statement of Facts," in reply to Mr. Henning, shall appear in our next.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

A complete list of Patents from the earliest period (15 Car. II. 1675,) to the present time may be examined. Fee 2s. 6d.; Clients, gratis.

Patent-Agency Office,
Peterborough-court, Fleet-street.

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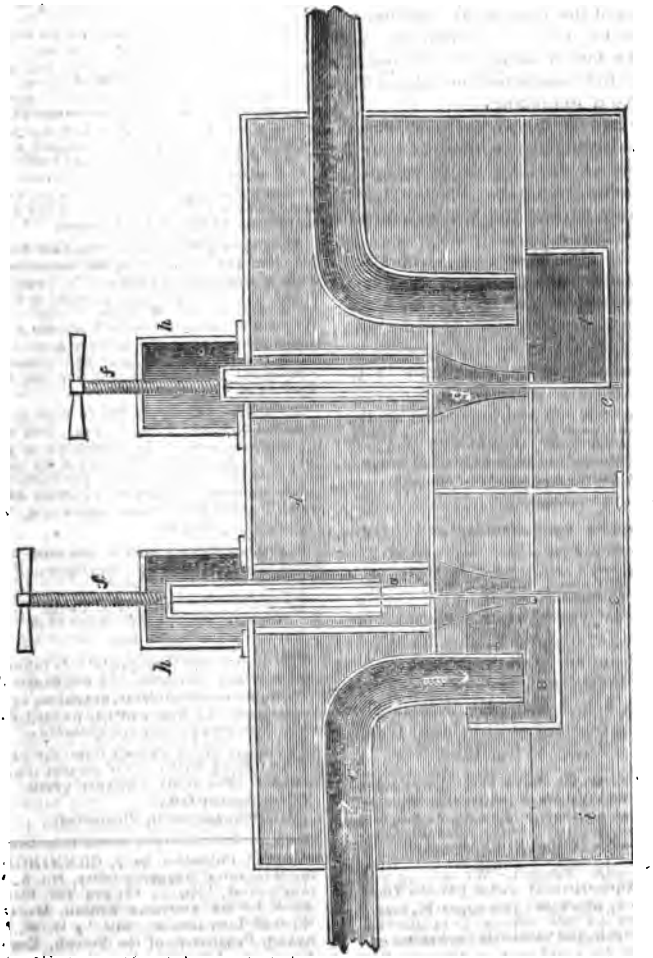
Mechanics' Magazine,

MUSEUM, REGISTER, JOURNAL, AND GAZETTE.

No. 707. SATURDAY, FEBRUARY 25, 1837. Price 3d.

HUTCHISON'S HYDRAULIC GAS-VALVE.



MR. JOSEPH HUTCHISON'S HYDRAULIC GAS-VALVE.

The inconvenience that frequently arises from the defective construction of the spring-valve generally used in gas-establishments, has led to several contrivances to obviate the difficulties that are continually presenting themselves. A perfect *hydraulic* gas-valve is, in my opinion, the only remedy for the evils that are complained of. Numerous attempts have been made by engineers to introduce an effective apparatus, and some very clever machines of this description have been published at different times in your Magazine.

It appears to me that the invention, of which I now beg to hand to you the accompanying drawing, is possessed of the necessary mechanical arrangement to render it a perfect air-tight valve. The inventor is Mr. Joseph Hutchison, father of Stephen Hutchison; many of whose improvements in gas-machinery your pages have made known to the world.

A valve precisely upon the same principle as that shown by the drawing was constructed by that gentleman in the year 1812, for a West India merchant, for whom Mr. Hutchison was at that time building a gas-apparatus on extensive premises opposite Meux's brewhouse, in Tottenham-court-road. This was previous to the period when the streets of the metropolis were first lighted by gas, and before the original Company (the Westminster) commenced operations, or obtained its charter.

For many years, after the above premises were vacated, the apparatus alluded to was forgotten and neglected, and it was only during an accidental conversation which I had with Mr. Joseph Hutchison about twelve months ago, that he happened to refer to this invention.

As it is likely, from the simplicity of its construction, to be remarkably well adapted to suit the purpose of a station-valve (it being now used as such on the Continent), I avail myself of the excellent opportunity your periodical affords of making the invention known for the benefit of gas-manufacturers.

Description.

d is a cast-iron tank; B *b* are two cups attached to the screws *f f*; *h h* are iron stays bolted to the top of the tank—which in conjunction with the rods, *e e* guide the direction of the screws; *a a* are hydraulic joints for the purpose of preventing an escape of gas when raising or depressing the cups. C *c* are outlet and inlet mains. The inlet main C is represented as being sealed against the entrance of the gas by means of the water which the cup B has taken up from the reservoir *i*; while the outlet *c*, in consequence of the seal cup *b* being lowered, permits the free escape of the gas to the street or district mains.

CLOVIS.

MEDALLIC ENGRAVING — STATEMENT OF FACTS IN REPLY TO MR. JOHN HENNING'S CHARGE OF PIRACY AGAINST LACHEVARDIERE AND CO.

Sir,—A letter from Mr. Henning, respecting the conduct of Lachevardiere and Co., having appeared in the *Mechanics' Magazine* of the 4th inst., I request leave to reply to it by a statement of facts. The contemptuous manner in which Mr. Henning is pleased to speak of the engravings by M. Collas, published by that firm, does not, I think, require further comment than will be found in his own correspondence, herewith forwarded —except only to direct attention to his admission, that he has just entered into an engagement with Mr. Bate for the publication of a rival work. This, I admit, ought not to influence his judgment; whether it has done so, I shall leave your readers to determine, strictly confining myself to the specific charges affecting moral character which this person has dared to bring against Lachevardiere and Co., and which you have somewhat incautiously ventured to publish. The wrongs of which Mr. Henning complains are, "of foul robbery and shameless appropriation of his laborious works from the Parthenon and Phygaleian marbles;" of "the unjustifiable omission of his name in the letter-press of the *Trésor de Numismatique*;" of "the wholesale appropriation of his works to the ruin of their legitimate sale, and the blasting of his reputation;" of "the atrocious piracy of the Company by the seizure of the 'Canterbury Pilgrimage' of his late son;" lastly, "that having [in 1836, observe] spoken before the Committee of the House of Commons of the unjustifiable omission of his name in the *Trésor*, he was by 'a trick,' 'an unworthy manœuvre,' induced to write a letter to the Chairman of the Committee, acknowledging that he had *since* seen a copy of that work with his name in it, which letter is now shown about with the intention of impugning his veracity."

Now, if I desired to impugn Mr. Henning's

veracity, I should not refer to *that* letter.* I beg leave, however, here to state, that the unworthy manœuvre by which it was obtained, was simply the production of the *Trésor* itself with his name in it—when, and under what circumstances placed there, will appear hereafter—and that the letter was *sealed* by Mr. Henning, and, of course, so delivered to the Chairman on the same day, and has never since even been seen by me, or any other person connected with Lachevardiere and Co. I now proceed to the more serious charges. This correspondence, be it observed, was opened by a letter addressed to Mr. Lenormant, the Editor of the *Trésor*, who communicated with Messrs. Lachevardiere on the subject, and they immediately returned the following answer:—

"Translation of a Letter from Messrs. Lachevardiere and Co. to John Henning, dated Paris, 11th November, 1834.

"Sir,—Mr. Lenormant has communicated to us the letter which you have addressed to him, and in which you complain of the sale of our engravings from your reduced intaglios of the bas-reliefs of the Parthenon. The work is not sold in London on our account. The booksellers in Paris, who have a regular connexion with some of the London booksellers, have bought it from us without telling us any thing about the ultimate destination of the copies, and they are sold there on their account. We quite agree with you, Sir, that this property belongs to you, and that you are the only master and possessor of it, and we are therefore *quite disposed to do any thing that may be agreeable to you*, to compensate in some manner a real disappointment to you, in which, however, we are not directly concerned. The publication of this work *being now terminated*, it would be extremely difficult to alter the text and to introduce your name, as the author of the reduced bas-reliefs, which we have employed. *If, however, you attach great importance to it, we will do so, regardless of any expense which it may cost us.*† We can only offer you, to make up for the little injury, copies of this work, which you may distribute among your friends. *If there be any other mode which you would prefer*, only have the kindness to inform us of it,—we hope we shall be able to satisfy you. We hold at your disposal, 1. Twelve copies of the collection of your bas-reliefs; 2. One copy on India paper; which we shall send you, free of expense, the moment we are acquainted with your address. Be so kind as to answer without delay, that we may enjoy the satisfaction of making amends, as far as it may be in our power, for the injury which this publication may do you, although we cannot but repeat, we are not directly the cause of it.

"We are, &c.

"LACHEVARDIERE AND Co."

Now, Sir, whether this was the reply of an honourable man, I leave to the decision of your readers. Mr. Henning thus described it:—"Mr. Lachevardiere gravely replied, that the matter concerning which I had written was an affair with the publishers in London; but he very politely proposed to send me thirteen copies (one on China paper), and that they should be delivered free of expense. Liberal compensation, certainly!" forgetting altogether that the offer was conditional—it being left to him to suggest "*any other mode of compensation which he might prefer.*" However, what Mr. Henning thought of it at the time, and before he had entered into the engagement with Mr. Bate, will best appear from his own letters:—

"Extracts from a Letter from John Henning to Lachevardiere and Co.

"Sir,—I received with much pleasure your letter of the 11th inst.; I am disposed to accept your offer of, 1. Twelve copies of the collection of bas-reliefs; 2. One copy on *papier de chine*—on which I will give up all thought of hindering the sale of your work here. *My first letter must have convinced you, that I was more hurt* at not being mentioned in your letter-press as the restorer of this very unique series of sculptures, *than from any supposed injury to the sale of my own work*. In fact, a gentleman having presented me with a copy, *I surveyed it in a kind of delirium of pleasure*, exclaiming at *intervals*, I wish that Mr. Collas had operated from more perfect casts !‡

"*I was so struck with the general beauty of the work*, that I accounted for some deficiencies (not *distortions*,) which I could not detect, as arising from defective casts which might have been used in doing the work, and this was a subject of regret to me..... I have just learned that you have also published engravings from my Phygalian sculptures. *I would only now think of proposing to publish my hypothesis* concerning the Centaurs, Amazons, and Lapithæ, and *connecting it with your work*, have it published at Paris first, but have it announced that an English edition would be published at the same time in London by Longman's house. This would secure the copyright with you, it would secure it here. I do not mean to propose that the work should be published with your work, because that would lead to an infamous claim of eleven or twelve copies to be given to institutions which have abundant means to purchase.

(Signed) "JOHN HENNING, sen.

"London, 18th November, 1834."

"From Lachevardiere to John Henning.

"We are in hopes that you have received the copies of the bas-reliefs of the Parthenon, which we have forwarded to you the 25th ult. *We now ask for your permission to engrave by our machines*, 1. Your reduced intaglios of the Cartoons of Ra-

* "11, Seymour-place North, Euston-square,
"July 7th, 1836.

"Sir,—Having been led to believe that a certain part of my evidence, given by me on the 21st of June, before the Committee on the British Museum, may be misconstrued, so as to imply a censure on the publishers, at Paris, of a set of engravings from my sculptures, after Parthenon and Phygaleian friezes, I consider it just to state to the Committee, that I am now in possession of a volume of that work, in which my name is introduced as the author of the reductions from which the engravings have been done, not only in the preface, but also in the index; this I find was done immediately on my complaining of the neglect, which I am now satisfied was unintentional. As I do not wish a false impression to go before the public, I beg that you will have the goodness to allow this to be inserted on the Minutes of the Committee.

"With the greatest respect,

"I have the honour to be, your humble servant,
(Signed) "JOHN HENNING, Sen.

"To the Chairman of the Committee."

† The reader will notice, that only one edition of the Parthenon has ever been published. But a second edition, with engravings from casts bought from Mr. Henning himself, will appear shortly, with the text in English.

‡ The first engravings were executed from casts bought in Paris from the Italian dealers in such commodities, at the current price of forty francs. Mr. Henning was paid 40*l.* for the original casts, purchased after the publication had taken place.

phael; 2. The sundry bas-reliefs, of which you have likewise executed reduced intaglios, *on the same terms as those that have been agreed upon for the bas-reliefs of the Parthenon.* We shall then desire you to make your own choice of the best plaster casts, ... you will be so obliging as to send us all these things packed up with care, ... and let us know the amount, so that we may remit it to you immediately.

(Signed) "LACHEVARDIERE AND Co.

"Paris, 5th January, 1835."

Here the reader cannot fail to observe there is an actual treaty with Mr. Henning—his permission is asked to engrave his "intaglios of the Cartoons of Raphael, and the sundry bas-reliefs of which you have likewise executed reduced intaglios, *on the same terms as those that had been agreed upon for the bas-reliefs of the Parthenon;*" and if he consents, he is requested to select and forward the best plaster cast, &c.—and it will appear from the following letters, that Mr. Henning did select and forward copies of such of his works as he thought would serve the "purpose" of his correspondent, and in due course sent in his bill for them, which bill was paid:—

"From John Henning, Sen., to Lachevardiere.

"Sir,—Yours of the 5th inst. arrived of course, *and casts have been made of my different reduced bas-reliefs, which shall be packed properly, that they may reach you in safety,* of which I will inform you on their dispatch ..... The Transfiguration by Raphael is too large *for your purpose* I am afraid, but if it may do by separating it into two, you might do it as the others, in which case, however, I would empower you to secure the copyright of the bas-reliefs according to the law of France.

"London, 27th January, 1835."

"From Lachevardiere and Co. to John Henning, Sen.

...." We accept with much pleasure your offer respecting your reduction of the Transfiguration. It is our intention to publish some numbers of an extra size, and this plate will form a part of the collection.....

" It is well understood that whatever you may think fit to send us *will be accepted on the terms already agreed upon for the bas-reliefs.*

"Paris, 12th June, 1835."

"From John Henning, Sen., to Lachevardiere and Co.

"My dear Sir,—I must acknowledge that I was very remiss in not informing you of the safe arrival of the impressions of your engravings after the reductions of the Parthenon and the Phygaleian sculptures..... Your work is much praised, and after distributing in presents a number of those which you had the goodness to send, I have at present six or seven ordered. Particularly desirous to serve one of my friends, I waited upon Mr. Bailliere and got a copy of the four numbers. I paid twenty shillings for it, and caused one of my sons to hand it to the Duke of Norfolk at the same money. I have not a doubt that had you mentioned my name* in your *letter-press in the first instance,* it would have had a great influence in promoting the sale. *Your beautiful work* has found its way into the first libraries in the land, and I have not met with one of my friends who enabled me to accomplish that work, which took me from seven to eight years, but who expressed a wish to have the engravings which you have done. I hope when you have done the Cartoons, that you will not forget the name of the old Scotchman, and, *I will do every thing in my power to promote the sale of your work among my friends here,* at Edinburgh, at Glasgow, Liverpool, and to the chief promoters of art in this country to whom I am personally known. I am just going to see Mr. Fellman at his lodgings, of whom I will *inquire at what rate I might be served from your house, that I may have the opportunity of serving my friends who might want them;* of course I would take care that they should be sold at the same rate that the printsellers, your agents, do here. *I beg to present you with a glass impression of an intaglio done by one of my sons, who fell in the pestilence of* 1832. I also send you a fac-simile of a letter from Canova, and with *the kindest wishes for your success, I am, with the greatest respect,*

(Signed) "JOHN HENNING.

"London, 30th June, 1835."

"From John Henning, Sen., to Lachevardiere and Co.

"Dear Sir,—Yours, containing a bill of exchange on Coutts' for 11*l.* 6*s.* 6*d.*, arrived safe..... I immediately prepared a cast of the Transfiguration, and, as soon as it was dry, opened the case to see that all was right within. It was pleasant to find all well, and room for some little things besides the Transfiguration. I have inclosed impressions from two dies of my first work of intaglio engraving in steel. If they are of any use to you, I beg that you will keep to yourself the secret of whom you have got them, and you may have the other four sides. ..... While I am in a fever about the safety of your case, I am surprised by a case containing two prints of Louis Philippe. ..... *I have to express my most cordial thanks for this mark of your attention. The execution is to my eye admirable; so much am I pleased with it, that I beg leave to ask if you would like to do a British design after this manner of our father shepherd, William IV. ..... Let me know how I might be able to serve you here as regards the publication of the Cartoons and Transfiguration here.* ..... I have had many applications for your engravings after my sculptures from the Parthenon and Phygaleian marbles. The applicants I have sent to Bailliere. After I had given away all that you had the goodness to send me, I had occasion to apply for one copy, for a very particular friend. Now, if *I could get them at what is called the dealer's price, I could often dispose of copies, as many have had my, who are wonderfully pleased with your work.*

(Signed) "JOHN HENNING, Sen.

"London, 29th March, 1836."

This is the last letter received from Mr. Henning, and here I am content to take leave of the subject. I cannot, however, but express a hope respecting the atrocious piracy of his son's work, that the reader will observe how it came into the possession of Lachevardiere and Co.†—and as to the insult offered to his widow, it is proved, by the letters here given, that it was positively agreed on between the parties, that for leave to engrave from all intaglios sent by Mr. Henning, they should give him the same remuneration as for the bas-reliefs of the Parthenon, that is to

* It is fairly to be inferred from this passage, that Mr. Henning knew at this time that his name had been inserted *in the Trésor*, and yet it was nearly twelve months after this letter was written that he gave evidence before the Committee of the House of Commons.

† Mr. Henry Hering sent a second cast at his expense for the purpose of being engraved on his account, as the plate had been sold to him at a stipulated price.

say, copies of those beautiful works which he "surveyed in a kind of delirium of pleasure" —which his friends were "so wonderfully pleased with," that he proposed to become an agent for the sale of them (see letter of 26th March) if he might have them at the trade price—but which copies he now describes as "bits of paper that might cost the Company a shilling a-piece." However, this was a question in which the widow rather than Mr. Henning was interested, and as she desired to have money instead of copies, her wish was complied with, as appears by the following receipt:—

"London, 24th Dec. 1836.

"Received the sum of four pounds sterling in full of all demands on the score of real or supposed injury by the sale of a medallion engraved by Collas, representing the 'Canterbury Pilgrimage,' published by him and engraved by making use of a bas-relief executed by my late husband, Mr. Samuel Henning, after Stodhart's picture.

(Signed) "ANN HENNING."

I regret, Sir, to have been obliged to trouble you at such length, but Mr. Henning's letters are the best answer to Mr. Henning, and essential to the justification of Lachevardiere and Co.

Yours, &c. VINCENT NOLTE.

GEOLOGICAL EVIDENCE IN FAVOUR OF THE ELECTRICAL THEORY OF THE UNIVERSE.

Sir,—I have read with considerable interest the observations of your several correspondents, relative to the Electrical Theory of the Universe; and from the arguments adduced on both sides, I am more and more convinced, that the general principles of that theory, when examined fully, and compared with geological facts, will be found to rest upon a good foundation. The principal feature of the theory is, that at one period of the earth's existence, it was attended by several satellites, like the superior planets, Jupiter, Saturn, and Uranus, which have been successively precipitated upon the earth's surface; and that which now accompanies the earth in its revolutions, will eventually follow the same course. Now the geological facts that have been already collected, give strong corroborative evidence of this opinion; some of these which have fallen under my observation, appear to give a degree of proof more full and satisfactory, than even those already submitted by the supporters of this theory. The present geological theories, it is well known, do not furnish consistent explanations of various important facts which have recently been brought to light; for instance, how granite came to be deposited upon the inferior members of stratified rocks? how, for a season, there appears to have existed a gradual increase in organic life—followed by nature, as it were, sinking into imbecility, incapable of the production of animation—and again, with renewed vigour, animals and plants being created? Further, how it was possible for the waters to deposit organic remains at such altitudes as those in which they have been discovered? to what cause we are to attribute the imbedding of fish in the solid rock, some in the very act of swallowing their prey, and others with the undigested remains of their newly swallowed food; the conical heads flattened, even the teeth broken, and the remains of various fossil animals otherwise shattered? These questions, and others of a similar character, are wholly inexplicable by the theories of Werner, Hutton, and other modern geologists; but by the admission of the hypothesis of the deposition of a satellite, they become of easy solution. In the first place, with respect to the deposition of granite on the inferior members of stratified rocks, as found in the Western Alps, where, according to M. Elie de Beaumont, granite rests upon limestones equivalent to a part of the oolitic series; at the Montagnes de l'Oisans, and also at Predazza, granitic rocks rest on beds of the Alpine limestones, and dolomite plunges beneath them at an angle of 50° or 60°. The position of the granite in this instance cannot, I think, be accounted for by a volcanic eruption; for if there had been a flow of melted matter from the interior of the earth, it would have found, in the same manner as the lava of a volcano, its lowest possible level, instead of resting upon high and steep mountains. But if the deposition of a satellite be admitted, those parts thereof which formed the superior members of its strata, would rest upon all those strata of the earth at that time existing; consequently, the granite of the satellite would be superior to all the strata of the earth, and in many cases to the strata of the satellite. Such a convulsion would also tend to destroy life of every description within reach of its effects: hence, at this period, there would be fewer animals in existence; and as the increase in vegetation is more rapid than that of animals, so those strata formed immediately after the deposition, would contain more vegetable than animal remains. The elevation of

mountains, as well as the existence of fossils on their summits, may be accounted for in the same manner. We see in various parts of the world, extensive chains of mountains of great altitude, corresponding in number to the satellites which this theory supposes to have existed. Why may not these several chains of mountains, have been the places of deposit of particular satellites, and the fossil remains found on their summits the productions of these satellites, differing as they do from the species at present existing on the earth. That most curious and interesting phenomena—fish being found imbedded in the solid rock, in the very act of swallowing their prey—has not yet been accounted for in a satisfactory manner. This occurs in that part of the strata called by geologists graywacke, whose characteristic feature is the impressions of fish, indicating most clearly the dreadful turmoil which existed at their entombment. At Mount Bolca, the most celebrated locality of fossil fish, the revolution which caused their entombment must have been sudden, for one specimen fish now in the gallery of the French Museum, belonging to the genus *blochius*, had not time before it died to let go another which it was in the act of swallowing. This fact has been reasoned upon, and its cause endeavoured to be shown, by several geologists, among whom is Dr. Ure, whose reasons I will give as a sample of those of others; he says, "in our climates when any fish (and especially one furnished with an air bladder) dies in summer, it remains at the bottom of the water for two or three days; it then rises to the surface before it becomes tainted, and falls to the bottom to rise no more, till putrefaction disunites its constituent parts." Hence, if some days had elapsed between the death of the blochius above described, and its getting impacted in the strata, it would have mounted to the surface, and thus it would have been separated from the fish which it was swallowing when arrested by the dreadful catastrophe. Other fish have been found in the same locality, in which are the bodies of others which had been newly swallowed; showing how quickly they had been killed after satisfying their appetites, even before the digestive powers so vigorous in these animals had time to dissolve their food. Those which we do find, must have been buried immediately after death in a bottom of sand or mud, which concealed them, and hindered them from mounting to the surface. Dr. Ure also adds, in endeavouring to account for their being so suddenly imbedded, that "it is not unusual to find a great number of fossil fish in one district, as in Monte Bolca and other localities, where a volcanic eruption, or some other revolution, had killed all at once. In certain places, their remains occur lying on their belly, or lengthwise, with their fins and tails extended. These remains, in some cases consist of bones, spines, and scales, distributed in their natural positions. In others they are found in a constrained posture, suggesting the idea they had perished in boiling water; examples of which have occurred in the submarine volcanoes of modern times. Lastly, in certain localities, as at Plattenburg, in the canton of Glaris, they are in a flattened state and covered with scales, but destitute of bony skeleton." Now does this reasoning of Dr. Ure account for the phenomena described? He allows and, moreover, proves, that they must have been buried immediately after death, inasmuch as they would soon be disunited by putrefaction, and the food they had swallowed would have been digested. He suggests the idea of their having been destroyed by boiling water, and, in proof, refers to the submarine volcanoes of modern times; a very ingenious mode certainly of accounting for their death—but how does this account for the formation of the rock in which they are imbedded? Does the rock present the appearance of volcanic action? Has it any of those features common to rocks of igneous origin, or have the strata immediately above or below it these peculiarities? Graywacke has not the appearance of a rock of volcanic or igneous origin, as it consists chiefly of argillaceous matter of a slaty texture, in which numerous fragments of other rocks and stones are imbedded: it, moreover, presents the appearance of a rock formed of the shattered parts of other rocks, consolidated into stone by the interposition of water; and if they were destroyed by volcanic influence, where and in what manner will the force applied to flatten them? The eruption of the boiling water must have been indeed sudden, when the poor fish had not the least intimation of its approach. Did ever Dr. Ure, or any of the readers of the *Mechanics' Magazine*, see a fish that had been destroyed by the action of a modern submarine volcano,

while in the act of swallowing its prey? I think not; neither does it appear to me reasonable. But allowing the deposition of a satellite to have taken place, a cause can be assigned sufficient to account for this and other phenomena of a like kind. The fall of the satellite would be so sudden, and so little intimation given of its approach, that every thing in that part on which it fell would be instantaneously buried; and by the fresh accession of matter there would not only be a rise of the waters, but they would undergo considerable changes in their position, they would retreat from the place of deposition with tremendous force, carrying every obstacle with them; tearing asunder the prominent parts of existing rocks, and intimately mixing the fish which were in the waters with these masses of rocks and the sands which had previously been forming at the bottom of the ocean. What power of pressure must there not have been exerted, to break the heads and bones of fossil animals, such as, for instance, the head and jaw discovered at Maestricht, the heads of the palæotherium and anoplotherium found at Montmartre, and the head of the *crocodilus priscus*, whose conical heads are not only flattened, but even the teeth are forced out and broken. "If I may be permitted to decide," says M. Sœmmering, "from my own anatomical and pathological knowledge, I should say that this compression of the head was not effected during the dry, friable, and brittle state of a skeleton; the injury appears rather to have been inflicted on the living animal, when the periosteum and top of the head could hold together the fragments of the bones, notwithstanding their crushed condition. Some attention, I think, ought to be paid to this circumstance—Why these once very strong heads and teeth should now be so broken and dislocated." No answer to my mind is so applicable as the force of the satellite, deposited on the earth: every thing must have yielded to it, and whatever gave only a comparatively small resistance, must inevitably have been crushed.

If these remarks are calculated to throw any light upon Mr. Mackintosh's Electrical Theory of the Universe, or to clear up any particular point, both Mr. Mackintosh and his supporters are welcome to them through the medium of your Magazine. And if you should think them worthy your attention, I will in another paper refer your readers to the deductions made from geology by Mr. Mackintosh, especially that part (Mech. Mag., No. 665, p. 429,) referring to the derivation of the Secondary and Tertiary rocks.

Yours, &c. JOSHUA THORNÉ.

LONDON AND BIRMINGHAM RAILWAY COMPANY.

Seventh Half-yearly Report.

The Directors since their last Report have entered into contracts for the works of the stations in London and Birmingham.

At the London end of the line near Camden-town, the Company have about 83 acres of land, intended as a depôt for the buildings, engines, waggons, goods, and various accessories of the carrying department of the railway. At Euston-grove they have a station of about 7 acres for the passenger traffic; and both stations are connected by the extension-line. Passenger-trains are to be moved on this portion of the railway, by a stationary-engine in the Camden depôt, and locomotive-engines are to be employed on every other part of it. At the Birmingham end of the line the Company have a station of about 10 acres, which will serve both for passengers and goods. The arrangement of these stations, and the plans for the necessary buildings and machinery connected with them, have been maturely considered, and the contractors are under penalties that the various works in London shall be completed by June next (with the exception of the façade of the Euston station, for which three months more are allowed), and the works in Birmingham by November next.

The entrance to the London passengers' station, opening immediately upon what will necessarily become the grand avenue for travelling between the metropolis and the midland and northern parts of the kingdom, the Directors thought that it should receive some architectural embellishment. They adopted, accordingly, a design of Mr. Hardwick, for a grand but simple portico, which they consider well adapted to the national character of the undertaking.

The plans and specifications of the buildings at the intermediate stations are in progress, and the whole of this portion of the work will be completed against the opening of the railway.

The greater part of the locomotive-engines required to convey the trains of passengers and goods, and of the necessary carriages of all descriptions, are also contracted for, and will be delivered in succession as they are required to meet the wants of the Company.

The Directors, in their late Reports, expressed an expectation that the first 21 miles of the railway from London would be completed in the spring of 1837. They regret to say that, owing to the late unexampled season, this expectation cannot now be realised before the summer. The engineer reports that the continued bad weather for the last four months, defeated his calculations in a degree which no former experience could have led him to anticipate. In some descriptions of soil this delay could not have taken place to such an extent as in the London clay, which is exemplified by the progress of the works on other parts of the line, where the material is more favourable; but in the London district the incessant falls of rain have rendered it quite impracticable to proceed with them uninterruptedly. With the excavations and embankments on the Primrose-hill contract he persevered until the extra expense was such as to induce him to suspend further operations; a step, in the propriety of which the Directors fully occurred.

The preceding remarks apply especially to the works of the embankments at the Brent, Tring, and the Wolverton Valley; all the minor works, however, have necessarily been affected in a similar way, though in a less degree; but as this delay does not interfere with the contemplated opening of the first 21 miles of the railway, it is unnecessary to remark upon them more particularly.

The works of the extension-line require but six weeks of fair weather to complete them.

The works of the Primrose-hill contract, which have been continued by the Company under the direction of the engineer, are nearly completed with the exception of the Brent embankment. The Primrose-hill and the Kensal-green tunnels are finished and traversed by the Company's engines, and the permanent way is laid through a great part of this contract. Of the embankment on the south side of the Brent bridge, about 58,000 cubic yards remain unfinished, to complete which, under an ordinary state of the weather, would require three months. That portion of the embankment which is north of the bridge is brought up to it, but not yet raised to the railway level. On the completion of the embankment north of the Brent, the engineer proposes to expedite the formation of the south portion of it by making 6,000 or 8,000 cubic yards of side-cutting, thus guarding against further disappointment as far as practicable.

From this point to Watford no work appears to require especial mention, the completion of the Watford tunnel, and the small quantity remaining in the excavations at each end, rendering any detailed remarks on this part of the line unnecessary.

The state of the three succeeding contracts is in general satisfactory, and the engineer reports that, with tolerable weather and a continuance of the same activity on the part of the contractors that they have hitherto displayed, the works may be completed, and the line opened to Tring, in the autumn. The North Church tunnel is already finished.

The quantity of water yielded by the cutting, in addition to that which has fallen in rain, together with the argillaceous character of the chalk in the Tring contract, rendered it absolutely necessary to stop proceedings on the embankment, and to confine them to the side-cutting and spoil. It is but justice, however, to the contractor to add, that he persevered in carrying on the embankment, until the engineer reported that it became positively impassable. Notwithstanding this temporary delay, the engineer is of opinion that the completion of this contract will certainly not be much protracted beyond October next.

By a new apportionment of the Wolverton embankment between the two contractors, the works will henceforth proceed satisfactorily.

The Blisworth works being now in possession of the Company by agreement with the contractor, all the skill of the engineers and the pecuniary resources of the Company will be exerted to recover the time lost, as upon these works will depend the opening of the whole railway.

Two lengths of the quicksand portion of the Kilsby tunnel have been completed, and the work there now assumes the ordinary character of tunnelling.

With respect to Blisworth, the engineer in chief reports, that arrangements are being made, by which it may be carried on with the utmost expedition:—"The rate of progress will depend, in a great measure, on the quantity of water, and the character and precise extent of the rock which has to be underset by masonry."

Respecting Kilsby, Mr. Stephenson states, that "unless a very unexpected quantity of water should be found, where at present no sign of it exists," we may reckon upon this tunnel being opened "from end to end in about seventy weeks."

The line between Birmingham and Rugby will probably be completed before the end of the year; and, as Mr. Stephenson states, "that after a careful investigation of the Kilsby and Blisworth contracts, and duly weighing the probable contingencies attendant upon the execution of such works, he is of opinion, that "*they may be completed in the summer of* 1838, *and that consequently the whole railway may be opened at that period;*" the Directors have every reason to rely on the fulfilment of the expectations on

this head, which in their successive Reports have been held out to the Proprietors.

The Directors took occasion in their last Report to congratulate the Proprietors on their anticipated accession of traffic from other railways, and amongst the number from the Derby and Birmingham, which was to join the London and Birmingham Railway at Birmingham, and at Stone-bridge. They have since learned, with regret, that a Bill is to be brought into Parliament by the Derby and Birmingham Company, for powers to carry their line from Tamworth to Rugby, instead of to Stone-bridge; and that a Bill is also to be brought into Parliament by another Company, to continue the line from Tamworth to the neighbourhood of Stafford, thus intercepting from the London and Birmingham Railway for the distance between Birmingham and Rugby a considerable portion of traffic on which this Company had every reason to rely. The Directors, therefore, in compliance with the declared wishes of the Proprietors, have made known their intention of opposing what they must look upon as competing lines.

The House of Lords having declared in the last Session of Parliament that the Cheltenham and Oxford and London and Birmingham Union Railway is not a "competing line," the Directors, in the conviction that the proposed communication will be of great importance to the Company, and in compliance with the wishes of the Proprietors, have decided to give it all the support they can.

The Directors were in hopes of seeing an efficient railway communication furnished to the population of Warwick, Leamington, and Kenilworth, by means of a branch communicating with the London and Birmingham Railway, near Coventry. The intermediate country was surveyed, and a Committee, consisting of influential parties in that neighbourhood, formed for the purpose of carrying the object into effect. The Directors regret, however, to say, that notwithstanding the pains that have been taken to select a line which should be unobjectionable to the land-owners through whose property it was to pass, the great majority of them are at present opposed to any practicable line, and the project has, therefore, been abandoned for the present; but the Directors will be glad at any future time, when, as they hope, the objections to the land-owners may be removed, to give all the support they can to this desirable undertaking.

The Directors have made a satisfactory arrangement with the Directors of the London and Birmingham and Thames Junction Railway Company, for the conveyance of the traffic of this Company upon their line, when required.

By the Statement of Account (A) now to be laid before the Proprietors, it will appear that—

	£	s.	d.
The Receipts to the 31st December, were	2,380,209	13	9
The Disbursements	2,285,321	2	5
That the balance in favour of the Company was at that date .	94,888	11	4

The Proprietors, in referring to these accounts, will observe that the original capital of the Company has been expended within 214,679*l.*

The Directors have been enabled as the work approached completion, to prepare estimates (B), which show that the contemplated works for the efficiency of the railway in the carrying department, as well as for the road itself, will require a sum of nearly one million more, and that the total outlay will probably reach four and a half millions.

This additional cost arises—

1st. From additions, alterations, and extras to the original plan of the works.

2d. From the extension-line to Euston-grove.

3d, From the additional quantity of land (800 acres), and the much higher price the Company have been compelled to pay than was at first estimated, a price in some degree extorted by the necessity of obtaining possession at an earlier period than by the provisions of the Act of Incorporation the Company could legally enforce.

4th. From the increased prices which it has been found necessary to give for all the materials composing the permanent way, such as rails, blocks, &c., as well as from the additional weight of the rails, chairs, &c., which experience has shown it to be prudent to use, and from the greater expense of conveying these materials to their destination, than was anticipated.

5th. From unforeseen difficulties in the Primrose-hill, the Blisworth, and Kilsby contracts.

6th. From the ample provisions made for the carrying department, and particularly with reference to the traffic to be expected from other railways, for which Acts have been obtained since the estimate was made.

On the whole, however, the Directors have reason to believe, that by this additional

outlay, the railway will prove much more equal to the work it will be called on to perform in the conveyance of the immense traffic to be expected; and that the cost of the wear and tear and annual repair will be correspondingly less, in consequence of the greater strength and solidity given to the works.

(A.)

GENERAL STATEMENT

Of the Receipts and Disbursements of the London and Birmingham Railway Company, to 31st December, 1836.

RECEIPTS.

1836.		£	s.	d.	£	s.	d.
Dec. 31.	Calls	1,728,796	18	3			
	Paid in advance on shares	21,595	2	0			
					1,750,392	0	3
	Loans.						
	At Four per Cent.	560,061	5	0			
	At Four and a Half per Cent.	49,300	0	0			
					609,361	5	0
	Miscellaneous Receipts, viz.:—						
	Penalties	1,505	0	0			
	Land re-sold and Rents	794	12	5			
					2,299	12	5
	Interest, viz.:—						
	Exchequer Bills and Bankers' Balances	16,818	8	6			
	Calls in Arrear	1,338	7	7			
					18,156	16	1
					2,380,209	13	9

DISBURSEMENTS.

1836.							
Dec. 31.	Amount, as per statement annexed	2,285,321	2	5			
„	Balance at the disposal of the Company	94,888	11	4			
					2,380,209	13	9

STATEMENT OF DISBURSEMENTS TO 31ST DECEMBER, 1836.

For obtaining Act of Incorporation	72,868	18	10		
Land and Compensation	579,499	11	5		
Conveyancing	6,328	3	4		
Contracts for Works	1,534,275	19	3½		
Engineering	49,654	11	3½		
Law Charges	5,006	9	10		
Advertising and Printing	2,611	2	5		
Direction	7,341	2	6		
Office Charges, Salaries to Secretaries, &c.	15,080	12	4		
Sundries, Travelling Charges, &c.	5,392	11	3		
Interest on Debentures	5,022	17	11		
Stamps	2,239	2	0		
				£2,285,321	2 5

R. CREED,
C. R. MOORSOM, } *Secretaries of the Board.*

(B.)

ESTIMATE

Of the Cost of the Railway to the Time of Completion, compared with the Parliamentary Estimate.

		Present Estimated Cost.	Parliamentary Estimate.	Excess.
		£	£	£
Land and Compensation		506,500	250,000	256,500
*Contract Works for forming the Road		2,146,068	1,703,830	442,238
†Rails, Chairs, Blocks, Sleepers, and incidental Charges		693,822	366,977	326,845
Stations and Carrying Department:—				
Buildings	£154,621			
Locomotive-Engines	100,215			
Carriages, Waggons, &c.	153,500			
		408,236	80,000	328,236
General Charges:—				
Expenses of obtaining Act of Incorporation	72,869			
Law Proceedings, including Expenses of Amended Acts	12,000			
Conveyancing	53,800			
Engineering and Surveying	127,100			
Direction	13,300			
Office Charges, Salaries to Secretaries, &c.	27,515			
Printing and Advertisements	4,800			
Sundries, including Travelling Charges, and all other Expenses	10,600			
		321,984	99,191	222,791
		4,076,610	2,500,000	1,576,610
Euston Extension (including Passenger Station)		255,722		
		4,332,332		
Interest on Loans		114,262		
Total Estimated Cost		£4,446,594		

R. CREED;
C. R. MOORSOM, } *Secretaries of the Board.*

* WORKS IN FORMING ROAD.

The engineer states,—

That owing to an increased width in the railway, increased slopes, and increased dimensions of several of the turnpike-road and canal bridges, his revised estimate exceeded the Parliamentary estimate by £110,240

That the whole of the contracts were let below the revised estimate; that the excess of expenditure chiefly arises in the following contracts, viz.:—1. Primrose-hill, about six miles in length, including the Primrose-hill tunnel; 2. Blisworth, about five and a half miles; 3. Kilsby tunnel; which were thrown on the Company's hands in consequence of the great and unforeseen (and in the cases of the Primrose hill and Kilsby tunnels unprecedented,) difficulties which occurred in the progress of the works, and that this excess may be thus apportioned:—

1. *Primrose-hill Contract.*

Additional outlay from the extremely disadvantageous circumstances under which the Company were compelled to take up the contract	£21,636	
Ditto in new roads, bridges, and sewers, required by diverting existing roads through Camden Town Depôt, and on other parts of the contract	27,552	
Ditto in additional strength necessary to the two tunnels, from the peculiar nature of the London clay	34,151	
		83,339

2. *Blisworth Contract.*

The additional outlay required to make good the loss of six months of time, and also for the completion of the costly parts of the works which have fallen to the Company to execute 60,000

COCHRAN'S MANY-CHAMBERED NON-RECOILING RIFLE.

(From the *American Railroad Journal.*)

This extraordinary invention of a young American, native of New Hampshire, and which is now being for the first time exhibited to the public, at the fair of the American Institute, Niblo's Garden, deserves more than a passing notice. There are circumstances connected with it, which give a peculiar, if not romantic, interest in the history of the arts of our country. If any thing were wanting amidst the multitude of extraordinary inventions which have, for the last half century, been recorded in the archives of our patent-office, to illustrate and establish the pre-eminent claims of our countrymen to genius of a high order, it would be that which forms the particular subject of our remarks.

Mr. Cochran's father was a lawyer, and afterwards a merchant of eminence in Enfield, N. H.; and the son, John Webster Cochran, was born there, and has invented the species of fire-arms in question, was brought up to no particular business. At the very early age, however, of sixteen, he discovered a strong taste and passion for mechanical experiments, and was constantly occupied in the construction of machinery, which his father approving of, unlike many other fathers, encouraged, and to further the wishes of his son, expended several thousand dollars in his behalf, in the cost of the different kinds of apparatus required.

When only eighteen, he made the discovery in question, but did not perfect it until three years after. He then went to France and England, and exhibited his model cannon to Louis Philippe and William IV. While at Paris in 1833-34, he was requsted by the Turkish Ambassador to explain it to the Turkish Minister at London, and accordingly went to Woolwich, and performed a series of experiments before the latter personage, which gave so much satisfaction, that he urged Mr. Cochran to visit the Sultan at Constantinople, and for that purpose provided him with the most flattering recommendations to the court of the Sublime Porte. Mr. Cochran arrived at Constantinople, February 11, 1836, was received with great distinction, and introduced to the Sultan by the Grand Vizier. His Turkish Majesty was highly pleased with the experiments made with the model, told Mr. Cochran he was satisfied it would be generally adopted, and requested him to cast twelve pounders on the same principle. He was provided with elegant apartments in Pera, raised to the dignity of Master of Cannon, and furnished with as many workmen as he required for the accomplishment of his task. The treatment, in fact, which he received, was equivalent to that of the rank of an ambassador.

Mr. Cochran, however, finding there was no good foundry or mechanics, was obliged to undertake the work with his own hands; and though not brought up to the business of making machinery of any kind, by dint of much labour and perseverance, made himself all the necessary implements, the augers and the wooden apparatus for boring with horse-power, and the preparations required for procuring the proper castings. By good fortune he succeeded entirely to his wishes, and cast and bored three cannon, two of one pound each, and the third a *twelve-pounder*, which last was finished in a style as perfect as he could have desired. On

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3. *Kilsby Contract.*

The occurrence of an extensive bed of quicksand lying over nearly one-fourth of the whole length of tunnel, and requiring to be drained by powerful steam-engines, which must be kept at work till the completion of the contract; the other parts of the tunnel abounding in water, and rendering it necessary to increase the number of shafts to an extent which could not have been foreseen	140,000
Extras on the remaining contracts	49,650
	442,288

† RAILS, CHAIRS, &c.

The increased weight of rails, and the rise in the price of iron, have caused an excess of	258,000
The additional price of blocks, sleepers, &c., and incidental charges thereon, above the estimate	21,845
The number of stations on the line more than contemplated, and the consequent addition of rails, blocks, &c.	47,000
	£326,845

The excess of expenditure for land and compensation, and for the carrying department, is accounted for in the Report.

R. CREED,
C. R. MOORSOM, } *Secretaries of the Board.*

the 14th of September following, he proved this last piece to his entire satisfaction, in the presence of all the chief officers of the Turkish government, who were delighted with its execution, and made a highly flattering report to the Sultan. He fired it off in the presence of those officers to their utter astonishment 100 times in fifteen minutes. The Sultan, when he heard of it, would scarcely believe it, and directed Mr. Cochran to perform the same experiments in his presence. The most extensive preparations were accordingly made for this important trial, which was to take place at Tarache, on the European side of the Bosphorus.

No less than 3000 troops were assembled at this spot. The Sultan, at the hour appointed, came over from his summer residence on the Asiatic shore, rowed in one of his splendid *caiques*, and preceded by a long line of other boats of the same description. The one which announced the approach of the Sultan was manned by 40 oarsmen, and came with even more lightning speed, than that in which his august highness himself was seated. As the latter was seen nearing the wharf, Mr. Cochran, at the suggestion of Halil Pacha, the Sultan's son in law, and commander-in-chief of the land forces, fired off a salute of 21 guns (the customary number) with the experimental cannon, which consumed less than two minutes, and struck the assembled multitude with the utmost amazement.

As the Sultan at this moment stepped on the wharf, Halil, accompanied by the Grand Vizier, and other dignitaries, ran to his Majesty, and the former, making the usual salaam of kissing the Sultan's foot, announced to him with feelings of exultation that could scarcely be repressed, the wonderful success of the machine cannon, as they appropriately named it. The Sultan arrived at his tent, then sent for the *master of the cannon*, the title which was given to Mr. Cochran, and after a short conference with him, in which Mr. Cochran conversed chiefly in the Turkish language, which he had partially acquired, the Sultan renewing his expressions of kindness, requested him to perform the experiment in his presence. His Majesty placed himself within a few feet of the piece, and Mr. Cochran commencing rather sooner than was anticipated, the Sultan, then with his back towards the cannon, was somewhat startled at hearing the explosions suddenly succeeding each other with such inconceivable rapidity, The cannon was fired 100 times as before in 15 minutes, during which the barrel acquired 650° of heat, while the revolving cylinder which contained the charges was comparatively cool, being only 250° of the temperature. The Sultan's exclamation expressive of his delight, was "God save the Americans—if such boys as you (Mr. Cochran being then but 21) can invent such things, what can your men do."

He then asked him for the bill of expenses, and being told by Mr. Cochran it was left at his own pleasure, he went the next day, at the request of the Sultan, to visit him at his palace. The bag of gold he there received, was truly an imperial present, and enough to make his fortune. The amount would scarcely be believed should we name it, and we do not feel ourselves authorized to specify the sum more distinctly than may be inferred from what we have said.

Mr. Cochran soon after returned to America, with an understanding that he should have a contract for supplying a large number of cannon of the pattern exhibited, whenever it could be agreeable to him to execute it.

These adventures of Mr. Cochran, yet a youth, seeking in a foreign land that patronage and encouragement which were the proper measure and appreciation justly due to his pre-eminent talents, and which it is lamentable to be obliged to confess, his own countrymen would not have bestowed upon him; recall the similar examples of West, Fulton, Perkins, and others, and are calculated to reflect discredit upon our national reputation, inasmuch as Americans ought to be the first to reward these incentive powers which are so emphatically characteristic of, as well as honourable to, the genius of our people.

Description of the Invention.—The invention of Mr. Cochran is adapted to every species of fire-arms. The articles at present being exhibited by him at the Fair, are a model cannon similar to that experimented upon before the Turkish Emperor, and a rifle complete, which we shall now proceed to describe. He has fired this rifle 1200 times, 500 of which discharges were in rapid succession, and

without producing any expansion whatever in the chambers of the cylinder, or giving it a greater temperature than 100° of Fahrenheit. As many as 2000 discharges are required before the rifle will have been properly tested after the rule of the war department. Mr. Cochran is ready at any time to fulfil this compliment and go beyond it. This afternoon he will fire it at Niblo's Garden 500 times in succession. The cylinder is a solid piece of iron, revolving in the plane of the barrel, and occupying a position directly at the base of the barrel which it is in close contact with. The dimensions of the cylinder are, in diameter about four inches, and in thickness seven-eighths of an inch. There are in this one, nine open chambers for the charges, which chambers are perforated upon the periphery and converge, like the radii upon the centre. The cones on which the percussion caps are placed, form another series of radii concentric and within the circuit of the chambers, a solid metallic partition dividing all the caps from each other. Each cone for the cap communicates with its appropriate chamber, and opens in the centre of the chamber, so that the whole charge of powder is ignited at once, by which the explosion of all the powder is made in one half the time of ordinary rifles, and therefore so much the more force given to it, and consequently a much less charge is required, the weight of the charge being only *one grain and a half.*

As each chamber in its revolution comes in exact line with the tube of the barrel, the cock strikes the percussion cap, and the explosion takes place instantaneously. The chambers, as they successively come into a line with the barrel in the revolutions of the cylinder, are momentarily retained firm in this position by the *regulating dog* connected with the cylinder where it joins the breech, and the pin of which dog catches in the small perforations made at equal distances for its reception. Nor can the cock strike the percussion cap until it is in exact position; for if the chamber is not in its proper place, the socket into which the hammer of the cock falls has presented to it only the metallic portions between the cones, and therefore on striking these no explosion can take place. Nor can any accident happen from explosions of the other chambers contiguous to the one in connexion with the barrel. Such an accident never did happen with this rifle, and if it should, the direction of the chambers is such that their charges would do no mischief. Nor can the flash of the powder in the chamber in a line with the tube of the rifle be communicated to the other chambers, as the joint of the cylinder, where it comes in contact with the barrel, is so close that it is air tight, and will not permit of such extension of the ignited powder. The charge of one grain and a half of powder requires a size of ball of fifty to the pound, and the force is sufficient to perforate eight boards each of one inch thickness, at the distance of sixty feet. The arrangement of the ball is another beautiful and ingenious invention. Their diameter is exactly fitted to the chamber, but larger than the diameter of the tube of the barrel by an incremen equivalent to the depth of the spiral creases on the inside of the tube, so that no patch is required as in other rifles, for it is forced into the tube of the barrel, and exactly fitted to it, by becoming compressed into a cylindrical shape, and its sides grooved by the creases of the barrel, whereby it is kept firmly in its course, and move steadily and with such precision, and so closely wedged, that there is no *windage* can get before the ball and give an irregularity to its motion, a serious inconvenience to which all other rifles are liable. The aim of Mr. Cochran's rifle therefore is always deadly and sure.

By this arrangement there is another additional power acquired, for you have the entire force of the charge behind the ball until it leaves the muzzle, and in the same proportion is the velocity augmented, and, therefore, a less charge required on this account, as well as on account of the manner in which the percussion caps communicate with the chambers, as already stated. The creases of the barrel, as we before said, keep the ball exactly in its place throughout its whole course to the muzzle, whereas the patch, always used in ordinary rifles, is constantly liable to tear, which causes the irregularity in the ball's motion, and defeats the very object for which rifles were intended. The manner in which the percussion cones communicate with the middle of the chambers, causes the powder to explode in one-half the time it would if the ignition took place at the end of, and posterior to, the chamber.

As an evidence of the accuracy and effectiveness of this rifle, Mr. Cochran related a bear-hunt, in which he took part, a few days since, on the Moose Mountains, in his native state of New-Hampshire. He fired at the animal with the rifle now at the Exhibition, and lodged nine balls in his brain, while he was under full way, at the distance of some four or five rods from him. The bear was brought to the ground, and the nine balls recognised and identified from the others lodged near them, by the grooves made in them by the creases of the tubes, and by their cylindrical shape. His brother sportsmen, who had, until then, deemed themselves in possession of good sporting pieces, expressed themselves in raptures at the superiority of their young countryman's magic rifle.

Another remarkable property in this rifle is, that it has not the least recoil whatever, so that there is not the slightest jar or irregularity in the direction.

LIST OF ENGLISH PATENTS, GRANTED BETWEEN THE 27TH OF JANUARY AND THE 24TH OF FEBRUARY, 1837.

Miles Berry, of Chancery-lane, for certain improvements in machinery, or apparatus for making or manufacturing metal screws, part or parts of which are also applicable to shaping metal for other purposes; being a communication from a foreigner residing abroad. Jan. 28; six months.

James Hellewell, of Springfield-lane, Salford, Lancaster, dyer, and Aaron Fearn, also of Salford dyer, for certain improvements in the process of dyeing and scouring piece goods and other fabrics, and in the machinery or apparatus whereby the same is performed. Jan. 28; six months.

John Springall, of Oulton, Suffolk, iron-founder, for improved shoes for horses and other animals. Jan. 31; six months.

James Cook, of Birmingham, gun-maker, for improvements in gas-burners. Feb. 2; six months.

William Geeves, of Old Cavendish-street, gentleman, for certain improvements on steam-engines. Feb. 6; six months.

Michael Linning, of Hill-street, Edinburgh, one of the Clerks to the Signet in Scotland, for a certain improved method of operating for the purpose of converting peat moss and peat turf or bog into fuel, and obtaining from it tar, gas, and other certain substances or matters. Feb. 6; six months.

John Gemmell, of Stockwell-street, Glasgow, merchant, for certain improvements in steam-boats, ships, or other vessels, which are partly applicable to other purposes. Feb. 6; six months.

William Boarder, of Bradford, York, millwright, for certain improvements in steam-engines. Feb. 16; six months.

John Walker, of No. 3, Allen-street, Lambeth, Surrey, oven-builder, for an improved method of heating copper stills and boilers. Feb. 16; two months.

William Stedman Gillett, of Guildford-street, gentleman, for improvements in harness for draft and saddle horses. Feb. 16; six months.

Richard Burch, of Heywood, Lancaster, mechanist, for certain improvements in locomotive steam-engines to be used either upon rail or other roads; which improvements are also applicable to marine and stationary steam-engines. Feb. 16; six months.

Robert Smith, of Manchester, engineer, for certain improvements in the means of connecting metallic plates for the construction of boilers and other purposes. Feb. 16; six months.

John Isaac Hawkins, of Chase Cottage, Hampstead-road, C.E., for certain improvements in the application of the products of combustion in generating and in aiding of steam for giving motion to steam-engines; being a communication from a foreigner residing abroad. Feb. 16; six months.

Henry Elkington, of Birmingham, gentleman, for improvements in covering or coating certain metals with platina, and also improvements in gilding certain metals, and in apparatus used in such processes. Feb. 17; six months.

Henry Elkington, of Birmingham, gentleman, for improvements in covering steam-engines, and in boilers and furnaces used therein, and for other purposes. Feb. 17; six months.

John Chanter, of Earl-street, Blackfriars, and of Upper Stamford-street, Surrey, Esq., and **John Gray**, of Liverpool, engineer, for improvements in furnaces for locomotive-engines and other purposes. Feb. 17; six months.

Benjamin Baillie, of Henry-street, Cumberland Market, Regent's-park, metal frame-maker, for certain improvements in regulating the ventilation of buildings, which he intends to denominate Baillie's Patent Ventilation. Feb. 20; six months.

John Hardman, of Bradford, York, millwright, for a certain improvement or certain improvements in steam-engines. Feb. 21; six months.

Jasper Weston, of Dover, Kent, gentleman, for improvements in certain wheeled carriages. Feb. 23; six months.

John Thomas Betts, of Smithfield Bars, London, rectifier, for improvements in the process of preparing spirituous liquors in the making of brandy; being a communication from a foreigner residing abroad. Feb. 25; six months.

Thomas Bentley, of Cleckheaton, near Leeds, dyer, for improvements in fulling woollen cloths. Feb. 25; six months.

NOTES AND NOTICES.

The Weather-Prediction again. — Mr. Patrick Murphy, whose predictions of the coming weather, in rivalry of Francis Moore, were noticed a few weeks ago in the *Mechanics' Magazine*, has addressed a communication to the Meteorological Society, which honoured itself by publishing his vaticinations, *explaining* the "reason why" they happened to be contradicted by the event in every individual instance. The sum and substance of Mr. Murphy's explanation is, that somehow or other he happened to be out, not in his facts, but in the date of their occurrence: he predicted frost, and he also predicted thaw: both actually occurred (in January, be it remembered!) although unfortunately at very different *times* from those Mr. Murphy's followers were led to expect, so that we

had frost when he told us to look for thaw, and *vice versa;* thus in a *slight* degree lessening the value of his labours, and pretty well justifying him in considering his first attempt at weather-wisdom anything but a "lucky hit." But even this miserable shift will not serve his turn with regard to his general prophecy, that the "tendency of the month would be to *drought*,"—this January, as if on purpose to cut every inch of ground from under him, having been decidedly the *wettest* known for many years. He has, however, another "starting-hole." "Only wait," he cries, "till we have news from America,—though all my predictions have gone wrong *here*, I feel confident they have been found quite correct *in the Western hemisphere!*" (Alas! for the Meteorological Society.)

American Electro-Magnetic Engine.—A New York paper states, "We learn that Messrs. Davenport and Cook, of Saratoga, after three years' study and attention, had perfected an electro-magnetic engine, consisting of a stationary-magnetic circle, formed of disconnected segments. These segments are permanently charged magnets, the repelling poles of which are placed contiguous to each other. Within the circle stands the motive-wheel, having projecting galvanic magnets, which revolve as near the circle as they can be brought without actual contact. The galvanic magnets are charged by a battery, and when so charged, magnetic attraction and repulsion are both brought into requisition in giving motion to the wheel—the poles of the galvanic magnets being changed more than 1000 times per minute."

China versus Lyons.—The silk-manufacturers of Lyons have lately begun to complain that they are losing the custom of the United States. For some time, it is said, the Americans have shown a preference for the manufactures of China, and of late they have conveyed thither specimens of the newest patterns from Lyons for the purpose of getting them imitated by the Chinese. The result has been such an abundant supply of Chinese silks in the American market, that the United States now export them to foreign countries. If this be really the case, it supplies more reason to admire the cunning than the fair play of brother Jonathan, and may tend to show that, until some general law of copyright is adopted by the nations of Christendom, a pre-eminence in any branch of art, however it may contribute to national glory, can by no means be reckoned on as a sure source of national wealth.

Alderman Wood's Metropolitan Improvements.—The Report of the House of Commons' Committee on Alderman Wood's proposed metropolitan improvements has just appeared. It is by no means of alarming dimensions, as, including the appendix, it comprises only fifty-four pages folio. The lithographic plans which accompany it, fifteen in number, convey almost the whole information that is given respecting the proposed improvements. These we shall take an early opportunity of analyzing.

Action of Light on Dyed Colours.—M. Chevreuil, of the French Academy of Sciences, has recently laid before that Society an account of a series of chemical investigations entered into by him with relation to the art of dyeing. One of the most curious of these relates to the action of light on artificial colours, which has hitherto been supposed to be most deleterious, but is proved by M. Chevreuil's experiments to be almost entirely innocent—unless in conjunction with the air, with hydrogen, &c. He enclosed some specimens of dyed stuffs in bottles, from which the air was exhausted; and at the end of two years, although constantly exposed to the light, the colours had hardly sustained any alteration. Some other specimens of the same kind of stuffs, dyed by the same materials, were carefully kept from the light, but exposed to the air during the same space of time, and the result was that the colours had entirely disappeared. Might not this experiment supply a useful hint to the curators of the British and other Museums, in which valuable but easily destructible *objects are kept in glass-cases?*

Mr. Crosse's Experiments.—Mr. Von Humboldt recently presented to the French Academy of Sciences, some specimens of semi-transparent gun flint, in which, without any process of dissolving or beating small, a multitude of infusory animalcules might be discovered. Does not this circumstance tend to throw a light on the recent interesting experiments of Mr. Crosse, of Broomfield, described in page 384 of the *Mechanics' Magazine?* Although, as Mr. Crosse observes, neither acid, nor wood, nor flannel, nor iron ore, was one of the constituent parts of the compound from which in the second case insects were observed to emerge; yet both in that case, and in the preceding one, solution of *silicate* of potash was a principal ingredient, and gun-flint is a species of silex. It would thus appear, that the Voltaic action had properly nothing to do with the production of these insects which may have previously existed in the silex.

"New Manchester."—The Austrians appear determined to throw off their old character of a quiet and prosperous agricultural nation, and enter with all their might into the lists of commerce and manufactures. To the project for rendering navigable and navigating the Danube, is now added that for a canal, to be called the Lewes-canal, to connect the Danube with the Maine, and thus with the Rhine and German Ocean. It is calculated, that when this new road for commerce is opened, the Austrian capital will become the grand centre for the traffic to be carried on between Holland, Asia Minor, and the intervening countries. Not content with this, however, the citizens of Vienna are, it is stated in some of the foreign papers, about to establish a "new Manchester" all at once in the Brigitten-au (or Bridget's Meadow), near that city, in which, however, the motive force is not, as in its prototype, to be the power of steam, but the power of water. We would advise the projectors of this scheme not to be too sanguine in their anticipations. Neither Rome nor Manchester was built in a day.

The Remarks on the Birmingham Railway Report are unavoidably deferred till our next.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

A complete list of Patents from the earliest period (15 Car. II. 1675,) to the present time may be examined. Fee 2s. 6d.; Clients, gratis.

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SIR GEORGE CAYLEY'S NAVIGABLE BALLOON.

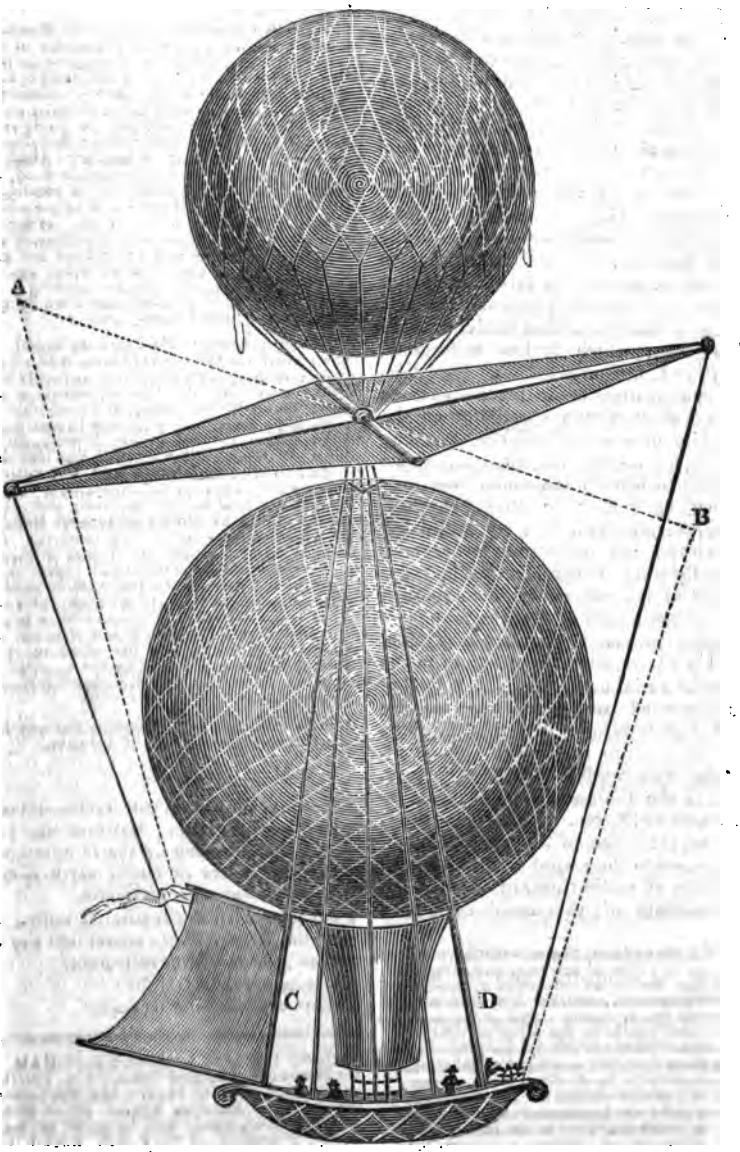

Plate 1.

PRACTICAL REMARKS ON AERIAL NAVIGATION. BY SIR GEORGE CAYLEY, BART.

Sir,—Permit me, through the pages of the *Mechanics' Magazine*, which widely circulates among the efficient mechanics of this engineering age, to call their attention to a subject of great national interest, and one that offers perhaps the most difficult triumph of mechanical skill* over the elements man has to deal with—I mean the application of aerial navigation to the purpose of voluntary conveyance. There seems to be, if we may judge by the scattered notices in the public journals, a revived attention to this subject, not only in this country, but also in France and America: the experiments that have been made, and the investigation which it has undergone, lie almost unconnected in the periodical publications of the last thirty years; and hence every new speculator on the possibility of steering balloons, takes up the subject merely on his own view; and as it requires much complicated calculation, as well as the utmost exertion of engineering skill, it is not surprising that we do not make much progress, especially when we consider the enormous expense of making experiments upon it on an *efficient scale of magnitude*.

Among others, five-and-twenty years ago, I paid considerable attention to the subject of aerial navigation, and collected or ascertained several of the leading points and laws of action that must be complied with to render any attempt respecting it successful. These were published in the *Philosophical Magazine* for 1816 and 1817, &c. I shall not, however, repeat much of what is there said, but proceed to state what I consider most conducive at present towards a final accomplishment of the aerial object in view.

In the first place, the enormous bulk of balloons, as compared with the weight they will sustain, causes the *difficulty* of impelling them, with sufficient speed to be of any utility, either by manual or engine power; and this *difficulty* is by many truly scientific persons considered as insurmountable, because they conceive that the bulk, which causes the resistance, must ever be commensurate with the weight of engine necessary to propel them by any species of waftage—and, consequently, as it will not do on a small scale, that it cannot on a large one. It is true, that it requires twice as much gas to sustain a 4-horse power engine as to sustain one of a 2-horse power (with their loads of fuel and water); but it is not true that the larger balloon, though perfectly similar in make to the smaller one, will, when driven through the air at the same velocity, meet with *double* the resistance—if it were so, the case of steering balloons would be hopeless, and on this mistaken ground many think it a vain attempt. This idea, resting at the very threshold of the invention, and which seems to present an insurmountable barrier, when probed and fully investigated proves to be false, and the investigation leads to an immutable law of proportion between the resistance and the capacity to carry weight or engine-power, which, on a very large scale, promises the most satisfactory result.

If balloons of the respective diameters of one and two, both being spherical, be driven through the air with equal speed, the resistance will be as the *surfaces* opposed to the air, and the surface of the largest will be four times greater than that of the smaller, and hence it will require *four* times the engine force to keep up the velocity; but the quantity of gas contained in the larger balloon is *eight* times greater than that in the smaller, hence it could sustain eight times as much engine-power; but four times that power would keep up the required velocity, and hence it could carry a cargo of the weight of its engine, and yet keep pace with the smaller balloon. The simple terms of the case are, that the surfaces (and hence the resistances) increase as the *squares* of the diameter of the balloon; whereas the capacity to contain gas (and hence the supporting power) increases as the *cubes* of the diameter.

From this *unquestionable* law it follows, that if similar shaped balloons vary in diameter as the numerals, 1, 2, 3, 4, 5, &c., the resistance they will meet with in the air, at the same velocity, when compared to the weight (or engine-power) they will sustain, will be as 1, ½, ⅓, ¼,

* This letter was commenced about four months ago; I am extremely glad to see how much this subject has grown upon public attention since that time, and how many excellent notices of it are contained in the last three monthly numbers of your Magazine up to September, which I have just received.

$\frac{1}{4}$, &c. This is a most important fact, and proves that as the law of relative diminution to resistance is *unlimited*, there must ever be, *theoretically*, some bulk in which any species of first mover, however sluggish in proportion to its weight, would find itself suspended, and its power adequate to propel that bulk with the velocity required. So far for the *principles* in action; let us now come to the real practical limits and bearing of the case.

The first thing that presents itself to our notice is the choice of a proper material of which to form a balloon for the required purpose; and the properties are those of being perfectly air-tight, light, and strong. Silk and Indian-rubber varnish are thus indicated, and have long been used; but in the larger constructions, that are suggested by the previous investigation, the expense of silk would almost prove a bar to real use. The double-cotton Indian-rubber cloth, used by Mr. Macintosh in his manufacture of air-tight seats and cushions of various kinds, weighs very nearly 1lb. per square yard, and will just sustain a tension of 2,500lbs. per lineal yard, that is, if the yard of cloth were rolled up and used like a rope, it would sustain any weight less than 2,500lbs. Of course, if used flat, as a portion of the surface of a balloon, it would sustain tension to the same amount. This cloth, when made to adhere to an adjoining breadth by an overlap of one inch with the Indian-rubber varnish, is air-tight at the seam; and is to the full as strong in resisting tension as at any other part, as I have found by experiments carefully made for the purpose.

As we now travel by railroad pretty constantly at the rate of 20 miles per hour, aerial navigation, though offering a direct navigable ocean to every point of our globe, would scarcely be worth cultivating, if not practicable ultimately at least up to that speed.

To be able to sustain the form of the balloon, when driven against the air with that velocity, implies that the condensation within must press rather more than the resistance of the external air; but at that velocity, by the well-known laws of resistance, every square yard near the centre, facing the line of flight, will meet a resistance of about 29lbs.; and hence the condensation over the whole interior of the balloon must give 29lbs. pressure per square yard. More than this, balloons, to be really serviceable, must when at anchor, or by accident driven against obstacles, be able to resist the action of our most violent storms, which, according to Smeaton's table, go at the rate of 60 miles per hour, tearing up trees, and creating a pressure of 162lbs. per square yard.*

This cloth can just sustain 2,500lbs. per lineal yard; and hence, by calculating the forces, it follows that the extreme limit of size to which a spherical balloon made of it could safely be carried when occasionally condensed to meet our storms, whilst at anchor, or when compressed against objects casually by them, would be 60 yards in diameter.†

Let us not be startled at this deduction, for in practice we may use as much less as we find convenient; and it is a feature of very great importance in favour of aerial navigation, that such a slight fabric is capable of becoming a safe vehicle of support to so vast an extent—and here it should be remarked, when balloons are made of forms differing from the sphere, that where for any considerable length they approach, as in elongated spheroids, to a cylindrical form, the cloth will only sustain near the minor axis half the pressure or condensation it will sustain as when in a sphere of the same

* These calculations are based upon the resistance being in the ratio of the squares of the velocities; and that a velocity of 21 feet per second gives a resistance in air of 1lb. to the square foot.

† The whole lineal measure of the circumference (being, in round numbers, 188 yards, capable of bearing 2,500lbs. each), can bear 470,000lbs.; whereas the whole area of the great circle on which the pressure takes place, being 2,840 square yards with a pressure of 162lbs. on each, only amounts to 460,080lbs.

In speaking of condensing the gas in balloons, which is a new feature in them, it will be necessary to provide a safety outlet by bringing a wide pipe from them, and placing the end of it a few inches under water; a column of 3½ inches of water would equal the condensation of 162lbs. per square yard. The escape of gas should be into a small empty balloon above the water, from which it can be pumped out at pleasure; the change of temperature in the climate also requires this structure. Eventually balloons will probably have a double casing, with common air, or, what would be safer, azote, pumped in between them. A small balloon to contain common air pumped into it, having a tube from it with its mouth a certain number of inches under water, and its bulk contained *within* the gas-balloon, would be the readiest way to meet all cases of condensation and expansion. With air-tight materials there would be no mixture of common air with the hydrogen, but this plan would require the materials to be perfectly so. To prevent danger from the fire of the engine, several wire-gauze divisions should be made in the chimney.

diameter; hence 30 yards would be the extreme limit of the shorter axis of an elongated spheroidal balloon made of this cloth.

As the netting, belting, or whatever means be adopted to enable the floating-power of balloons to sustain the burthens attached to them, must necessarily extend over more than half their surface, it would be best to complete the circuit, and thus add the strength of the netting to resist condensation, and fortify the cloth, especially near the shorter axis.

Condensation is a term that seems, and to a certain extent is, adverse to aerial navigation; but the whole condensation here required will only deduct 1lb. of buoyancy from every 120lbs. previously exerted by the gas, a sum too trifling to be of any consequence, and abundantly redeemed by the *firmness* it gives to whatever form it may be required to model balloons for obviating as much as possible the resistance of the air.*

The next consideration is the proper form of the balloon for this purpose; and here it is obvious, that to extend their length horizontally, and thus to diminish their cross-section, is the leading point of the investigation. This will be limited by the practicable extent to which the structure can be carried without incurring weakness, in respect to the preservation of form, or inconvenience in the mode of suspending the car or body from the balloon. Ships and boats range between three and six times the measure of their greatest cross-section; birds between two and four. When convenience has pointed out the limits that must guide us in making use of *length* to obviate resistance, the *form* of the balloon, to meet the least resistance within these limits, is naturally the next inquiry. Unfortunately even the sagacity of Newton has not been able practically to grapple with this very interesting and intricate question; and his beautiful theorem on this subject will not apply to any of our gross fluids, which wedge themselves up by accumulation after they have struck upon the resisting body, and have no free egress to make room for others. The Newtonian solid of least resistance has a prow concave near the anterior axis; and as air is more elastic than water, the prow, if we may use the term, of birds is also concave; whereas in fishes the prow, as in ships, is convex. In the absence of all good authority, I have proposed (at p. 400 of the *Philosophical Journal* for 1816) to copy the prow of the woodcock as there given by exact measurement. This bird was selected from its having frequently to pass 500 miles of sea at one flight; and because in its structure Nature seems to have united every contrivance to blend strength with lightness. The resistance of the air to its passage was the great obstacle to be overcome; and hence it is more than probable the best form (which, more than all the rest, would tend to the ease of the performance) has been selected also. It is about 3½ times the length of its greatest cross-section.

The hinder portion of resisting solids is proved by experiment to be of as much importance as the prow; but as its office is to fill up the space, shielded from pressure for a time by the diverging momentum of the fluid driven off by the prow, any figure approaching to that of the cone answers the purpose tolerably well, if we may judge by the lengthened conical taper of the tails of fish; indeed it is a common expression among sailors, that a ship to sail well should have a "cod's head and a mackerel's tail."

We may rest contented to make our experimental balloon of an extended spheroidal form, and leave the rest to future improvement. The best form of ships remains in a great measure to be ascertained yet; although navigation has been bestowing wealth and comfort on mankind for so many ages under a rude approximation to it.

The next objects of inquiry are the power to be used in propelling the balloon, and the means of applying that power. Only two general modes have, I believe, ever been proposed by competent persons for this purpose. My friend Mr. Evans (see the *Philosophical Magazine*, for 1815, vol. xlvi., p. 321,) tried with success to steer a small Montgolfier balloon by suspending a large oblique surface beneath it, which caused the ascent to be oblique in the direction towards which the upper edge of the plain was pointed; when the fuel failed, gravita-

* The expense of using pure hydrogen gas points out the necessity of balloons being perfectly air-tight, and when used as permanent vehicles, and on the true scale of magnitude, they will probably be made of thin metallic sheets kept firm by condensation, with separate light bags of gas within.

tion made its return *obliquely* to the place from which it set out; had this plain been reversed when at the top of its rise, steerage towards the same point of the compass would have been effected in both cases by this sort of vertical tacking.

This movement implies the use of the fire-balloon; but it does not follow that the *whole* support must necessarily be given on that principle: suppose that two-thirds of the weight of the whole machine were suspended by a hydrogen-gas balloon, by any sufficient length of cordage (say it required from 50 to 100 yards), to ensure all danger from fire. Immediately above the car place a fire-balloon, likewise capable, when fully inflated, of supporting two-thirds the weight of the whole apparatus. When both balloons operated upon a large oblique inclined plain, with a power of ascension equal to one-third of the whole weight, it would render the oblique force very efficient in ascending; and when at the highest point of elevation the heated air is let off by the valve, and the plain reversed, one-third of the whole gravitation would give it an equally effective oblique descent. A machine on this construction would, on account of its progressive motion, obey a rudder, by which more exact steerage could be effected. It is certainly the most simple and least expensive way of primarily effecting the problem of steering balloons; but there is something unsatisfactory in being obliged thus to resort to such alternating heights and descents, implying such sudden changes of temperature, to say nothing of the devious and prolonged nature of the track, and the consequent waste of power. I send you a rough and hasty sketch of such a combination of balloons, having a large inclined plain suspended between them, capable of being pointed obliquely for either tack by cords from the car, as shown by the present position of the plain, and the dotted line A B, plate 1. The balloons are made in such proportion to each other as to be of equal power, their contents being as ten to four* very nearly. Several strong ropes should pass from the collected cordage of the upper balloon through the interior of the lower one, as exhibited by the dotted lines, and be made fast to a large hoop forming the top of the chimney; this is partly held up by the two light masts C and D, and forms the means of suspending the car from both balloons, as the cordage from the netting of the lower balloon is also collected on this hoop. From the hinder mast C a sail may be conveniently braced to either side, so as to act as a rudder, and thus preserve a steady course. It is necessary to have a long chimney in Montgolfier balloons, when *speed* is required, to give sufficient pressure within to balance the external resistance, this must be 75 feet long to balance the resistance of a balloon at 20 miles per hour; and is, no doubt, a great inconvenience in this mode of action. The balloon sketched is supposed to be 30 feet in diameter, with 10 feet of chimney, thus giving 40 feet of columnar height at the top of the balloon, which would create a pressure equal to the external resistance, at a velocity of about 14 miles per hour. I do not offer this as a finished model, but merely sufficient to exhibit the principles in a visible form.

Steam, or any mixture of it with heated air, does not offer much prospect of advantage in filling Montgolfier balloons, and if it did, it could only be used when the balloons were of enormous magnitude, so that the proportional diminution of surface and increase of thickness in the materials, had greatly diminished the condensing power of the external air with Indian-rubber cloth of 1 lb. to the square yard, which would nearly absorb all the power of the 30 feet balloon I have specified, it would (according to some experiments I made, on cooling, with that cloth,) take about 100 lbs. of coke per hour to supply its condensation of steam at the ordinary temperature of our atmosphere.

Let us now consider the more direct plan of steerage by the waftage of surfaces to which engine power is applied. Some persons doubt whether if such power can be conveniently suspended to balloons, it would be efficient, because there are not *two* fluids to work upon, as the water and air in the case of ships; but this argument does not apply since the introduction of the steam-boat, where the wind has no concern in the movement; and, indeed we might as well doubt whether the muscular power in the bird's wing is that which propels it forward, as doubt that engine-power,

* 27 ounces per square yard in hydrogen-gas; 11 ditto hot-air according to the French experiments on Montgolfier balloons.

if properly applied to balloons, will have a similar effect.

My friend Mr. Goldsworthy Gurney has just completed some steam-carriages, the boiler and engine parts of which weigh no more than 200 weight per horse-power;* the supply of coke and water will be about (10 coke, 60 water) 70 lbs. per hour—say 30 lbs. more for the constant quantity left in the fire-place and boiler, and we have each steam horse, with its load for an hour in the weight of 300 lbs. If we take loads for several hours, and use no means of saving water by condensation, which might readily be done, the loads per horse-power will stand thus:—

	Lbs.
For one hour	300
— two	370
— three	440
— four	510

This is at present our best practical result. In theory, however, it seems possible that we may obtain a horse-power at very high temperatures, and working by expansion only, at 15½ lbs. of water and 10 lbs. of coke per hour. Lighter first movers than steam-engines may be discovered, and made applicable to propelling balloons; but let us take the case as our experience now places it.

Here, in fact, commence the real difficulties we have to contend with in rendering balloons serviceable to mankind; we have as yet only obtained the grounds of calculation, and these, when correctly followed up, place the result of the question not on any point of defective theory; but whether it is, or is not, practicable to construct them so as to be firm, air-tight, and manageable, when of dimensions far exceeding any experiments that have been hitherto tried, *we must be contented to give up balloons for purposes of locomotion altogether, or to attempt them on that scale of magnitude which a well-grounded calculation of their powers proves to be necessary.*

It cannot, however, be thought useless, boldly and unflinchingly to *investigate* the case, which, if practicable, offers us the floatage of an uninterrupted ocean from every man's door to any other point on the globe;—let not such a boon to our race be given up without a fair and vigorous effort to avail ourselves of it in our own age. To commence:—suppose a balloon be made of the Indian-rubber cloth of Messrs. Macintosh and Co., in the form of an elongated spheroid thirty yards in diameter, and three and a half times that measure in length: although this would in bulk bear a strong resemblance to a hundred-gun ship, yet it would fold up into a cubical case 10 feet every way; and when inflated, is only a hollow bag received into a boundless ocean, where bulk ceases to be an inconvenience,—calculation proves that a condensation of one part in 120, will give it firmness sufficient to resist storms without affecting its form; and the cloth is known to be air-tight under much more intense condensation: surely, then, we can scarcely doubt the possibility of making such a balloon, or of inflating it by pumping, with pure hydrogen-gas, setting aside at present all consideration of the *cost* of the experiment.

The weight of the materials may be estimated as follows:—

	Lbs.
Indian-rubber cloth at 1 lb. to the square yard	9540
Mr. Green's great balloon contains about 2000 cubic yards of gas; this balloon will contain 49,000; and if the weight of the other materials be taken in proportion to these numbers, we shall have for the netting	3360
The car	3000
The grapples and other matters	3425
	18325
Each cubic yard of hydrogen-gas gives 1·7 lb. of floatage; hence the whole power will be	85·255
From which deduct the 120th part for condensation.....	693
	84·562
And also the weight of the apparatus.....	18·325
There will remain as the free power of the balloon.....	66·237

* Mr. Avery's American rotatory-engine will probably be still lighter if the loss of power do not balance its simplicity of structure.

Or about 29½ tons, which may be divided in any convenient proportions between the engine-power and its apparatus for waftage, the crew, and the cargo.

Before this can be done, it is necessary to have an estimate of the resistance of such a balloon when driven through the air at the velocity we propose to obtain. Extensive as this balloon seems to be, according to the best data, it could not be driven by the engines, &c. it could carry, at more than 17 miles per hour; and is better qualified to be driven at 14. It is extremely probable, however, that our data give the resistances of curved vessels considerably greater than is found to be the case in practice; but let us rigidly adhere to that which our present degree of information points out, and consider 14 miles per hour as the intended speed of our balloon. At this velocity there will be a resistance of 9 lbs. to the square yard when directly opposed to the current;—hence, as the greatest cross-section of this balloon contains 710 square yards, the direct resistance of such a surface would be 6390 lbs. Mr. Robins found that a sphere only meets with about one-third of the resistance of its great circle, being as 1 to 2·7; others have found it still less, but experiments are scarce on this subject. With a view to the present inquiry, I made a light case of papers, glued together over a true spheroidal mould, 18 inches long by 6 in diameter, and loaded it so as to fall through the air in the line of its longer axis. A circle of 6 inches diameter was then loaded till it fell with equal velocity, keeping perpendicular, to the line of its fall, the weight required to drag the flat circle with equal speed, side by side, through a fall of 30 feet, was 4·8 greater than that of the spheroid (of course the *whole* weight of each apparatus was thus the measure of the resistance.) The additional weights used to bring the circle to an equal velocity with the spheroid, were so arranged within similar cases, as to give equal resistance. This spheroid was just three times the length of its minor diameter; whereas the proposed balloon is 3½ times longer than its breadth, which will materially diminish its resistance—and it may, therefore, be safely taken at not more than a sixth part of the resistance of its great circle,* and in this case the resistance of the balloon at the proposed velocity will be $\left(\frac{6390}{6}\right)$ or 1065lbs. —and as the speed at which this force must be supplied is 14 miles per hour, or 21 feet per second, it is equal to 1065 × 21, or 22365lbs. raised one foot high per second, which divided by 550, the number of pounds raised one foot high by a steam-horse, quotes the power required as that of rather less than 41 steam-horses, call it in round numbers a 40-horse power, provided it could be applied from a solid fulcrum on the earth; but whatever kind of waftage may be employed, there will be a loss of power by its acting upon a rare and also a receding medium.

For the sake of perspicuity, suppose that the surface employed to propel the balloon be equal to that of its great circle, then it will receive as much resistance (following the law of the squares of the velocity, and the resistance of the spheroid being one-sixth of that of the great circle) at about 8½ feet velocity, as the balloon does at 21 feet; but before the wafting surface can give this resistance, it must go back with 8½ feet more speed than the balloon goes forward, so that the engine-power is working at a velocity of (21 + 8½) 29½ feet per second, and this requires the power to be increased as 21, the former velocity, is to 29½, or from a 40 to a 57 horse-power. Let us, then, consider our balloon as requiring, in round numbers, a 60-horse power.

The weight of the engine at 510lbs. per horse-power, with a load of fuel and water for four hours, will be 30,600lbs., which deducted from the 66,237, leaves 35,637lbs. of free floatage. Suppose the machinery for waftage to weigh as much as 13,000lbs., then there would still remain 22,637lbs. to convey passengers or cargo, say 100 men and their ordinary goods, or 10 men and a cargo of 21,000lbs. —about 9 tons.

This estimate was made on the plan of the direct waft backwards, merely for the sake of being more readily followed in its

* Mr. Tredgold, at p. 330 of his excellent work on the steam-engine, gives us all the particulars of the *James Watt* steam-boat, the length of which is to its greatest cross-section under water, as 5·7 to 1; and when the power which its engines can supply at the velocity, the paddles move with in still water is taken as a criterion of its only opposing force, the resistance, it does not appear to be more than one-sixteenth part of what the cross-section would receive. Hence we are probably allowing a much greater resistance to our balloon than on a large scale it will receive.

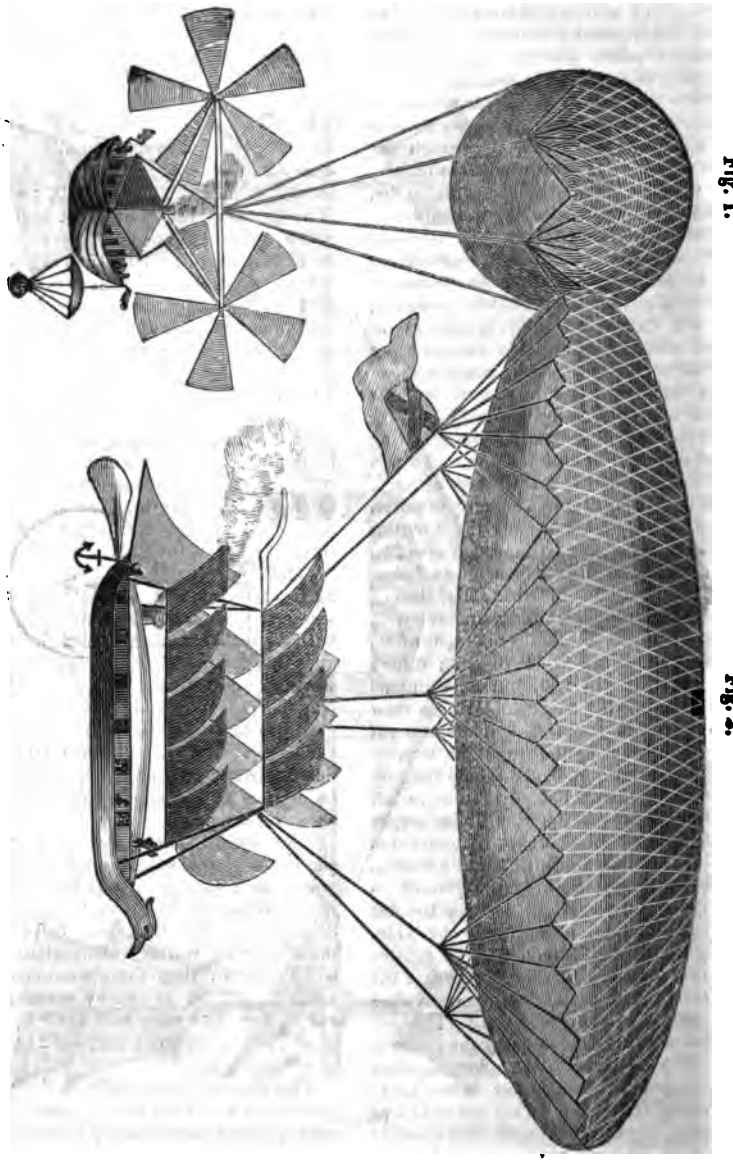

Fig. 1.

Fig. 2.

Plate 2.

various steps; and to avoid rendering the case intricate by adverting to that resolution of forces which takes place in oblique waftage, as in the wings of birds, the fins and tails of fishes, and in that which I am about to notice as applicable to our purpose.

It appears from the experiments of the French Academy, on the resistance of water at acute angles, corroborated by

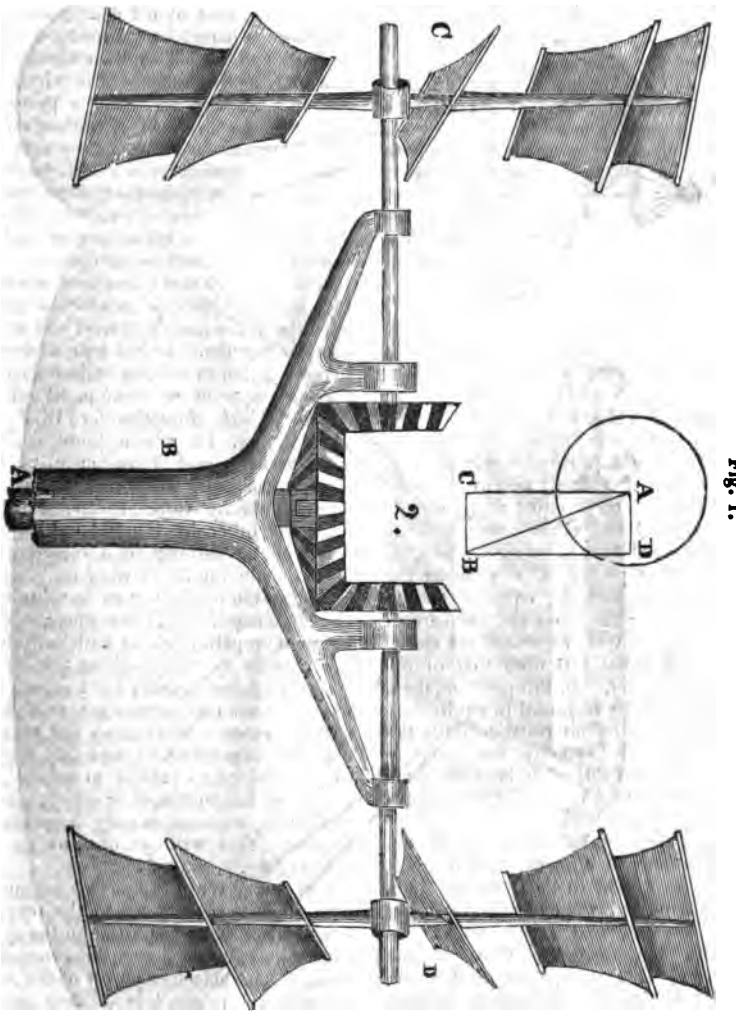

Fig. 1.

Plate 3.

the effect of the wings of birds in air, which give support to their weight when skimming at a very acute angle, that by oblique vanes, reversing, as it were, the action of the sails of a wind-mill, the proper fulcrum or resistance for the engine-power to work upon can be had at a velocity of 25 feet per second, in lieu of 29½; and hence a 47-horse power will be sufficient for our purpose—in round num-

bers, say a 50-horse power in lieu of the 60-horse power on the former plan. This cannot be proved without a complicate diagram, and an explanation that would obtrude too much upon your pages, and most probably on the patience of your readers on the present occasion.

This will enable us either to add 5,000 more to the cargo, or, by using a 60-horse engine, to go with more speed.

Many persons erroneously suppose that any propelling force of waftage, when acting in the direction of the *car*, will not tend to propel the *balloon* above it. Let A, fig. 1, plate 3, be a balloon; let B be the position of its car, propelled beyond its centre of suspension, A, by any given power of waftage. Draw A C perpendicular, and C B parallel to the horizon; and let these lines be made in the same ratio to each other as the weight of the car is to the propelling power; then the line A B will represent the whole action of the car upon the balloon. Draw A D and B D respectively parallel to the two former lines; and as the floatage of the balloon is equal to the weight of the car, B D will as truly represent the floatage as A C does the weight; and, as the propelling power is, as soon as the speed becomes uniform, equal to the resistance, being the cause and measure of it, A D must as truly represent the resistance as its equal C B does that of the propelling power. In this position, then, all the powers are balanced in equilibrio; but there will be no resistance till the balloon has the velocity necessary to generate it, and this it finds at the same speed in the line A D, as if it were moving along its equal C B.

I will here take advantage of the same diagram to observe, that if a balloon be supposed to be at anchor in a gale of wind, by the car being secured to the ground, and the line A D be taken to represent the force of the wind, and B D the power of floatage, then A B will be the position the cordage will fall back to. The resistance to the prow of the balloon in question, at a hurricane of 60 miles per hour, would be about 20,000lbs.—deducting the car then on the ground, its floatage would be about 63,000—so that it would fall back about one part in three, which are the proportions purposely taken in the diagram, in order to prove that permanently-filled balloons would ride out storms when properly secured, without the danger of being driven to the earth and damaged.

Some persons are, however, disposed to strike at the root of all discussion as to steering balloons, by affirming that no waftage can propel bodies suspended in one and the same element in which the waftage takes place. These persons I will refer to p. 172 of *Nicholson's Chemical Journal* for 1809, where they will find a description of a small machine, which they can make for themselves in a few minutes, that will elevate its own weight from the table to the ceiling, *merely by the waftage it creates*. The machine I have there described is a mere toy, but the *principle* on which it acts is capable of the most powerful and extensive application. I send you a view of its application to driving balloons, copied from a paper of mine at p. 81 of the *Philosophical Magazine* for 1817 (see plate 2, fig. 1), where there is likewise given a side elevation of a balloon with oblique wing waftage (fig. 2). The former by vanes revolving on an axis, the other by the heeling up and down of the surfaces in a reciprocating action, as in the bird's wing.

There is in one of the early volumes of the *Philosophical Transactions*, an account of propelling a boat with considerable velocity by men working this sort of waftage against the air; but I should prefer trying the more uniform action of the oblique vanes. More than one may be used on the same axis; and they may be so constructed as readily to apply their power, either to propel or retard, elevate or depress, as occasion may momentarily require. This will be obvious on inspecting fig. 2, plate 3.

Let the power of the engine communicate opposite movements to the reversed sets of fliers, C and D, through the cylindrical shaft A, and the wheels connecting them; the whole free power of the waftage will act in the line of their axis of motion. Conceive this axis to be moved into any position with respect to the horizon, by turning the hollow mast B (by which, through a suitable collar or socket the apparatus is supported from the car), and the balloon will be propelled accordingly. In the balloon we have been estimating, the four sets of such fliers would have to be 10 yards in mast or radius; and each sail would contain 30

square yards of surface. The figure given is intended merely to explain the principle of this action in the most distinct manner. In practice, this fabric, to unite strength with lightness, would be braced like the masts and sails of a boat; and its main strength derived from the ropes or metallic rods forming three braces.

Communicating centrifugal force to air by means of a hollow drum and fans worked by the steam-engine, is another means of getting a propelling power conveniently applicable in every direction that may be required; for by having a moveable mouth-piece, from which the air escapes, the re-action will always be in the opposite direction. Though convenient in this respect, it is too wasteful of power to be used for balloons, unless for small experimental purposes. Many other considerations remain untouched, upon; but I have already obtruded too much upon your pages with these dry details. The *subject*, however, is one of great interest, not merely in a mechanical point of view, but as to its stupendous effects on mankind at large; civilisation and, I trust, *perpetual peace* are in its train of consequences.

To such as have honoured me by wading through the train of this investigation, I will beg to remark, that they must not blame me for *wilfully* introducing such acres of cloth to their notice. Calculation from well-known data proves that balloons can only be driven with sufficient speed to be useful on the scale of magnitude I have pointed out. Let the question be put where it truly rests, whether such fabrics *can* or *cannot* be made and managed. The case is one evidently too great for individuals to make efficient experiments upon; and I am glad to see that some of your correspondents have recommended a subscription purse, and I hope that plan may be followed up. I proposed this in the year 1817, in the following terms (page 28, vol. l., *Philosophical Magazine*):—

"We, the undersigned parties, enter into the following subscription for the purpose of ascertaining how far the principle of balloons supporting heavy burthens in the air may be made useful as a means of conveyance.

"No person to be called upon for his subscription money till at least 1000*l.* be subscribed for.

"When the subscription has reached this amount, an annual Committee of seven of the subscribers to be elected. Every subscriber of 1*l.*, and of less than 5*l.*, to have one vote. Subscribers of 5*l.* to have two votes; and subscribers of larger sums to have one additional vote for every additional 5*l.* they subscribe.

"No experiments to be undertaken but by order of the Committee, who may call in the advice of such civil engineers as they chose to consult.

"An annual report of the application of the funds, and the result of the experiments made, to be printed for the use of the subscribers.

"These regulations being the basis on which the subscription is made, cannot be altered; but subsequent rules not militating against these, may be entered into at a general meeting of the subscribers expressly convened for the purpose."

The late Mr. Lovel Edgeworth immediately before his death became a subscriber of 50*l.* towards this fund, which his deservedly celebrated daughter subsequently offered to make good. Mr. Evans also became a subscriber; but the age was not then ripe for the subject—steam-boats were in their infancy, and railroad velocity unknown; twenty miles an hour then seemed monstrous and chimerical; now our only fear is that balloons will not have speed enough to satisfy our locomotive mania. I must not mention the respected name of Edgeworth without stating that he puts in a previous claim to that of Mr. Evans (see *Philosophical Magazine*, for 1816, p. 185,) to the principle of steering balloons on the tacking plan by the use of the inclined plain. He appears to have communicated the plan to Monsieur Montgolfier in the year 1782. Mr. Evans is, however, the first person that has proved the invention experimentally.

Balloons, as has been long ago observed, ought not to be made all in one, but have several departments for the gas, like "the stomach of a leech,"—and should the promoters of aerial navigation get up a purse and combine their efforts during the present season, I should strongly recommend that Mr. Green's large balloon, and that gentleman's great experience and skill, be put in requisition; that two other of the largest balloons that are in town be packed at opposite sides of this large one, under one netting made in compartments for the purpose; the whole free floatage may then be ex-

pected to be equal at least to 23 men; let the crew be Mr. Green and his assistant, and let the weight of twenty-three men, say 3400 lbs., be occupied by the lightest possible tubular boiler and high-pressure steam-engine of 5-horse power, which, no doubt, would be got up with a 4-hours' load, at 2500lbs., leaving 1100 lbs. as the weight of the fliers for waftage. This might be expected to drive the balloons at from seven to eight miles per hour, which would be quite sufficient as a *first* experiment.

As men have the choice of time, in a great degree, those winds that are tolerably favourable to any intended voyage, can often be selected; different current in the air can also be occasionally met with, so that balloons offer more advantages from the wind, than inconvenience from its occasionally being too strongly against their line of sailing.

I have been applied to by an ingenious foreign mechanic, now in Rome, who affirms, that by a particular apparatus of his own, he has guided small balloons with considerable velocity; that he is in possession of an engine four-times more energetic, weight for weight, than the lightest of our steam-engines (the powers of which I gave him, as stated in this letter), and that he wishes much to exhibit the proof of what he says, in London, should he meet with any persons who would pay the expenses of his journey; previous to which, he offers to satisfy any of the British residents in Rome that he can perform what he asserts. Should a good subscription-purse be obtained for general ballooning purposes, it may be just and desirable to give this humble workman an opportunity of substantiating his claims, by thus previously exhibiting his machine to the celebratep artists, Mr. Gibson and Mr. Macdonald, or other well-known British residents in Rome. For my own part, I shall be ready to become a subscriber to any rational plan for trying experiments upon balloons on truly scientific principles, and free from any *jobbing* or *exhibition*-making speculations.

Let the friends of aerial navigation be called together by advertisement in your pages, at the instigation of a few names favourable to the project; let a place—say the Adelaide Gallery, if the proprietors permit it — and some convenient day in next month, be named; and from this meeting let such resolutions emanate, as may best ensure the progress of *The Society for Promoting Aerial Navigation.*

I am, Sir,

Your obliged and obedient servant,

GEORGE CAYLEY.

Forwarded Jan. 23, 1837.

AEROSTATION.

Sir,—My thanks are due to Mr Lake, for the pains he has taken to correct an error into which it appears I had fallen, in an article published in your 637th Number, on the practicability of guiding and directing air-balloons. I know it is usual occasionally when a palpable blunder appears, to take shelter behind the *printer's devil*, by representing it as a typographical error; however, on the present occasion, I have no desire to interpose this shield, but will readily admit that it might possibly have been so stated in the manuscript, although with Mr. Lake, I cannot "imagine how I could make so great a mistake in so simple a calculation." A mistake it certainly is; and as Mr. Lake, I dare say, will readily allow me the credit of the blunder, I am willing to repay his courtesy by conceding to him the honour of having corrected it. Mr. Lake thinks it seems that the strength of a hundred eagles or so, would be as nothing if applied to overcome the great resistance opposed to the progress of a balloon against the wind, but thinks that great power might be gained from an air-pump. Well, if Mr. Lake likes the air-pump better, I have no objection. But afterwards, seeming to forget himself, he breaks out into the grandiloquent style and says, "we see the eagle possessed of *power*, not merely sufficient to raise its ponderous body from the earth, but also giving it a velocity outstripping the wings of the wind." Therefore, says Mr. Lake, eagles would be of no use whatever.

Farther on he says, "the effect (that is of the aforesaid air-pump) would be so certain, and the means of applying it so simple and easy, as to leave comparison with any method already known out of the question." Those who understand the subject, will not be disposed to entertain any doubts as to the effect, I believe, looking at the means proposed; but "the effect" would be of a very dif-

ferent description to that which Mr. Lake seems to anticipate. In the conclusion of his letter he says, alluding to *his* plan, "I am sure your readers must acknowledge its *simplicity*." Here I agree with Mr. Lake, I think they *must*.

I am, Sir, &c.

T. S. MACKINTOSH.

CASE IN TURNING.

Sir,—I send you the following answer to H. F. H., p. 249. The common length of band will be 109·82 inches; the diameters of the two circles required will be 24·036 and 22·025.

Solution.

1st groove on pulley 3 inches diameter	4·71	inches semi-circumference.	
Circle to correspond, 26 inches	40·85	do.	do.
Length of band between the centres	64·26	do.	do.
	109 82		
2d groove on pulley, 5 inches diameter	8·64	do.	do.
Circle to correspond, 24·36 inches	38 26	do.	do.
Band between centres	62·90	do.	do.
	109 82		
3d groove on pulley, 8 inches diameter	12·57	do.	do.
Circle to correspond, 22·26 inches	38 49	do.	do.
Band between centres	61 76	do.	do.
	109·82		

The above is sufficiently correct for practice; but the band will be slack when on the 3-inch pulley, because the band goes off in a tangent before it leaves the horizontal axes.

Yours, with respect, WILLIAM ANDREWS.

Ivinghoe, Bucks, Jan. 10, 1836.

N. B.—I answered a similar question in vol. ix., proposed in vol. viii. p. 231.

M'CULLOCH'S STATISTICAL ACCOUNT OF THE BRITISH EMPIRE.

Every body has heard of the startling remark of Sir Robert Walpole, when his son proposed to read history to him in his retirement, "Any thing but history, for that *must* be false." Something similar might well be the exclamation of the searcher for a true knowledge of the state of things from the imposing columns of figures in official returns—"any thing but statistics, for they *must* be incorrect." Look at the population returns, for instance, which form the grand magazine of facts to which the statistician has access. However valuable they may appear in the aggregate, it is notorious that no one can inspect those parts of them which relate to any district or neighbourhood with which he may happen to be well acquainted, without discovering a multitude of errors and misrepresentations (however occurring), quite sufficient to mislead any one who might be compelled, by want of the requisite local knowledge, to place a full reliance on their accuracy. The sources of mistake are necessarily extremely numerous, but they are multiplied to an immense extent by the wider range which the census returns have lately—especially on the last enumeration—attempted to take; by the minuter subdivisions which have been introduced, with the *intention* of procuring materials for a correct estimate of the condition of the people, as well as

their numbers, but with the *effect* of puzzling the matter more than if the details sought had been still left to the vague conjecture of individuals.

Notwithstanding these drawbacks, however, of whose importance he seems to be pretty well aware, Mr. M'Culloch, the well-known lecturer on Political Economy, and author of the "Dictionary of Commerce," and several other works of the same complexion, has thought the present a fit and proper time for putting forth a new "Statistical Survey of the British Empire."* It must be acknowledged that a standard work on the condition of the United Kingdom has been for a long time one of the most crying of our literary desiderata,—but we are by no means so well satisfied that the method adopted by Mr. M'Culloch is the proper one for filling up the vacuum so completely as it ought to be. After remarking in his preface, that the work of Chamberlayne, published in the reign of George the Second, was the last of the kind of any authority, he goes on to observe, that "during the long interval between Sir William Petty and Dr. Beeke, statistical science could scarcely be said to exist," but that, much information having been given in the Censuses of 1821 and 1832, and in the recent Reports of Parliamentary Committees and Crown Commissioners, "the time seemed to be at length arrived when it might be attempted to compile a work that should give a pretty fair representation of the present condition of the United Kingdom." Here we join issue. The grand work that is to take its place as *the* standard Picture of Great Britain will derive a good deal of assistance, of course, from the (too) large accumulation of raw material contained in the Parliamentary Reports, but its foundation must be laid on the basis of ORIGINAL RESEARCH, and not a stone used in the superstructure from the mass so temptingly at hand, until its trustworthiness has been tested by actual experiment. In other words, the authors of such a work must see with their own eyes, and make use of the population and other returns only so far as they tally with the results of actual observation. Mr. M'Culloch, it will be seen, does not think this troublesome process necessary. His work is entirely and altogether a compilation—a book made up of scraps from other books, without the writer's troubling himself to walk half-a-dozen steps from his library to ascertain from a peep at the out-of-doors-world whether any feature of the picture he was drawing of it was like or no: in short, a book where every thing is taken upon trust, and no addition made to the general stock of information. It is not a work so got up that will definitively fill up the "aching void" which is generally admitted to exist.

The plan followed is nearly the same as that of Peuchet, in his "*Statistique Elementaire de la France*," relieved a little of its excessive dryness,—for, strange to say, on dry subjects our usually lively neighbours approach to the proverbial aridity of "a lime-burner's basket." Our author says on this head,—

"We have not been satisfied, for example, in giving an account of any branch of industry, with stating the value of its products, the number and wages of the people engaged in it, and so forth; but have, in addition, given some notices of its history, and of the more prominent circumstances that have accelerated or retarded its progress. This seemed to be necessary to impart interest to the work, to make it useful, and *to give it a chance for getting into circulation.*"

A rather strange confession to be made by a statistician,—a dealer in nothing but mere figures, amounting, as it does, to an admission that his own peculiar department is without either interest or utility, and (which is most to the point, and doubtless true enough,) without *saleability*. Most readers will be perfectly ready to concur in the whole of this candid estimate of the value of bare "statistical science," *per se*.

The work opens with a general view of the "Extent, Physical Circumstances, and Civil Divisions of the British Empire;" the first chapter, subdivided into various sections, being devoted to England and Wales. This geographical portion is well executed, and appears to be a sort of abridgment of that part of the "Library of Useful Knowledge" devoted to "Physical Geography"—a subject on which many numbers of that series have recently appeared. Nor is

* A Statistical Account of the British Empire, exhibiting its Extent, Physical Capacities, Population, Industry, and Civil and Religious Institutions. By J. R. M'Culloch, Esq. Assisted by numerous Contributors. In 2 vols. London, 1837. C. Knight and Co. 8vo., pp. 642—700.

this the only part of the work in something like the same predicament: no small quantity of the remainder of its contents having appeared at one time or other in some of the multifarious periodicals issued by the Society, especially in the *Penny Cyclopædia*. Of course this matter is dovetailed in here by the Society's consent, as we are informed in the preface, that, although edited solely by Mr. M'Culloch, it is published with the sanction, and, we believe (for the point is left in a rather obscure state), at the expense of the ex-Chancellor's "literary club." For the general part of this introductory chapter we are indebted to the editor himself—the sections which follow, on the Geology, Climate, Botany, and Zoology of England and Wales, are respectively contributed by Mr. R. Bakewell, Dr. Copland, Sir William Jackson Hooker, and Mr. Swainson: each of these is good of its kind, but being the production of hands working independently of each other, they do not perhaps combine so well as might be wished to form a harmonious whole: they have too much the air of separate essays, rather than parts of the same work; though this is by no means offensively apparent. The "Statistical Sketches of the English Counties," which succeed to the general view, are too short to allow of any thing more than a very meagre outline of the capacities and characteristics of each; and even this, so far as it is founded on statistical authorities, is too often of a misleading nature. Thus, under the head Herts, after a tolerable, but too short topographical sketch, we are informed that the largest town in the county is Hemel Hempstead, which is represented as far exceeding even the county-town in population. This is one of the many instances of error produced by the population returns. The town in question is, in fact, a small and unimportant one, far exceeded in every respect not only by Hertford, but by St. Alban's, which is not noticed at all in this "Statistical Survey," and many others; it happens, however, to have a very large extent of rural district parochially attached to it, and, the census returns being made from the parishes, the numbers of the country population (exceeding by three or four times that of the town *proper*) go to swell up Hemel Hempstead to the dimensions of a "town of the first importance;" while St. Alban's, being split into several parishes, with no rural district at all, is left out altogether. There are numberless such instances as this, some of which are indeed noticed by Mr. M'Culloch himself; and such being the case with the simple enumeration of the people, what reliance can be placed on these same returns when they relate to matters so much more recondite, as their ages, occupations, &c. We happen to know that a certain parish in the suburbs of London, which is entirely covered by houses, flourishes in the returns as finding agricultural employment for 47 families, while its next neighbour countrywards, which is of infinitely greater extent, is built on only in a small proportion, and contains a number of farms, besides "numbers without number" of market gardens, nurseries, pleasure-grounds, &c &c., is made to support only 19 families of the same description! In fact, without some means of correction by local knowledge, the population returns are merely "blind leaders of the blind;"—those who make use of their guidance had need to keep their own eyes wide open into the bargain.

To "England and Wales" succeed similar notices of "Scotland" and "Ireland." Part II. is devoted to a summary of the various population returns, chiefly in the "dry bones" form of figures alone; and Part III., which is the most copious of all, relates to that widely-ramifying subject, the "Industry" of the British empire, commencing with Agriculture, from which we pass on, through Mines, Minerals, and Fisheries, to the almost inexhaustible subject of "Manufactures," on which Mr. M'Culloch is much more elaborate than on any of the preceding divisions. After a general sketch of the "Circumstances favourable to Manufactures" in this country, he proceeds, in the style indicated by the short extract we have quoted from the Preface, to devote a section each to the Woollen, Cotton, Linen, and Silk Manufactures, one to Hardware, Watches, Jewellery, &c., another to Manufactures in Leather, one to Earthenware and Glass, and one to Paper; the whole winding up with a section on that gigantic subject of Breweries and Distilleries, and a second on Miscellaneous Productions, Hats, Soap, Sugar, &c. Each of these articles contains a good deal of in-

formation, although, of course, most of the matter is by no means startling for its novelty. As a specimen of Mr. M'Culloch's manner of handling this extensive portion of his plan, we extract nearly the whole of his history of the Earthenware Manufacture, which we have selected principally because its dimensions are of rather a more manageable nature than those of the necessarily more lengthy articles on the Woollen and Cotton Manufactures. The subject, nevertheless, is in itself by no means deficient in interest:—

"The manufacture of earthenware, or, as it is frequently called, stoneware, is of very considerable importance. It is carried on in several parts of the country; but its principal seat is in the district called, by way of distinction, the 'Potteries,' in the north-west part of Staffordshire. It is doubtful when the manufacture was originally established here; but it has certainly been prosecuted at Burslem for the last two centuries. Dr. Plot, whose 'Natural History of Staffordshire' was published in 1686, gives what is believed to have been a very accurate account of the manufacture at that time. The wares were then of the coarsest and commonest sort, and consisted principally of pots for the preservation of butter, whence Burslem is, in several old maps, marked with the appellation of 'Butter Pottery!' Plot says that the wares were 'chiefly sold to the poor crate-men, who carried them at their backs all over the country!' About the year 1690, some improvements were introduced into the manufacture by two foreigners of the name of Ellers. Superior clays were also brought from Dorset and Devonshire; and the fabric of the ware was improved by the addition of pounded flints, &c. Still, however, British earthenware was very inferior in beauty to that of France, which was, consequently, imported in considerable quantities, and was almost the only thing made use of by the more opulent class of customers.

"It was not till about the year 1760, or 1762, that the grand era of improvement commenced in the potteries. We are indebted for it to the exertions and example of Mr. Josiah Wedgwood, who did for the manufacture of earthenware what Arkwright did for that of cotton. This eminent individual was the youngest son of a potter, was very indifferently educated, and received but little property from his father. But these untoward circumstances, far from repressing, served rather to stimulate the native vigour of his mind. His original and inventive genius enabled him to make many important discoveries; while his practical acquaintance with the business gave him the means of successfully introducing them into practice. Besides improving the composition, the glaze, and the colours of the old wares, he invented several that were altogether new; and (which was least to be expected from a person in his situation) he made vast improvements upon the figure of the articles manufactured, displaying in their formation a degree of classical elegance, and purity of design, which materially improved the national taste, and has never been surpassed. In addition to this, Mr. Wedgwood successfully exerted himself to improve the communications with the potteries; and was mainly instrumental in carrying the Act for the Trent and Mersey Canal through Parliament, and in accomplishing that grand undertaking. The village of Etruria, where his works were situated, was built by him. Since his death, which took place in 1795, they have been carried on by his descendants.

"The inventions and discoveries of Mr. Wedgwood were soon universally introduced, and the manufacture has since continued gradually to extend and to improve. Its progress, we are assured, has been such, that a workman of the present day can, in a given time, produce about *four* times the quantity of manufactured articles he could have done in 1790!

"Exclusive of earthenware, china-ware is also extensively manufactured in the pottery district. It is estimated that the value of the various sorts of earthenware produced at the potteries may amount to about 1,500,000*l.* or 1,600,000*l.* a year, and that the earthenware produced at Worcester, Derby, and other parts of the country, may amount to about 750,000*l.* more; making the whole value of the manufacture 2,250,000*l.* or 2,350,000*l.* a year. The consumption of gold for gilding, &c. at the potteries, is about 650*l.* a week, and of coal about 8000 tons a week.

"The finer sorts of clay used in the potteries are principally brought from the Isle of Purbeck, in Dorsetshire, and from Devonshire; stealites, or soap-stone, is brought from Cornwall, large quantities of flints from Kent, and some from Wales, Ireland, &c. The canals by which Staffordshire is intersected, and which unite the potteries with all the principal ports of the kingdom, afford the greatest facilities for the conveyance of the raw materials used in the manufacture, and for the easy distribution of the wares to the great markets at home and abroad.

"The population of the pottery district, which is naturally poor and barren, is exceedingly dense. It comprises from 60,000 to 70,000 inhabitants. The principal places are Burslem, Shelton, Longton, Stoke-upon-Trent, Henley, Lunstell, Lane-End, Etruria,

&c. But several of these are now joined together; and, to a stranger, the entire district has the appearance of a large, straggling town. A very large proportion of the population is employed in, and a still greater is dependent for support on, the manufacture. With the exception of gold, most of the materials made use of are worth very little; so that the value of the finished articles, as well as their exquisite beauty, and aptitude to every purpose of utility and ornament, is mainly ascribable to the skill and labour employed upon them. The wives and children of the workmen are usually employed; and, though they work together in factories, yet, as they reside in separate cottages, the manufacturer partakes largely of the domestic character. The wages of a whole family amount to a very considerable sum. The noxious process of glazing, so injurious to the health of those employed, has been rendered nearly free from its deleterious effects by the substitution of boracic acid for lead, what was formerly used in the proportion of 100 per cent., but now only of 8 per cent. The people employed in that branch were formerly not admissible into clubs, and were considered as degraded objects, from the insalubrity of their employment; but they are now gladly received into benefit societies (*First Factory Report*, B 2, p. 78). On the whole, the workpeople have a healthy, comfortable appearance. The population of the new parliamentary borough of Stoke, comprising the principal places in the potteries, is about 57,000, and of this number 12,997 were in 1833 attendants upon Sunday schools.

"Owing to its extreme cheapness, excellent cream and blue-coloured stone-ware is now found in every cottage; and it has every where superseded not only the old, ill-glazed clumsy delft ware, but also pewter plates, and the greater part of the wooden dishes that were formerly used in the kitchen and the dairy. It is not easy to overrate the influence of this change, in diffusing a taste for cleanliness, and for increased comforts and conveniences, nor have its advantages been confined to this country. It is now widely spread over all parts of the world; the annual value of the exported articles being at present very near 500,000*l*. Formerly, as we have seen, we imported large quantities of stone-ware from France, and at a previous period from the Dutch potteries at Delft; but the produce of our own potteries is now every where held in the highest estimation. An intelligent foreigner, M. Faujas de St. Fond, when noticing the English earthenware, observes:—'Its excellent workmanship, its solidity, the advantage which it possesses of sustaining the action of fire, its fine glaze, impenetrable to acids, the beauty and convenience of its form, and the cheapness of its price, have given rise to a commerce so active and universal, that, in travelling from Paris to Petersburgh, from Amsterdam to the extremity of the South of France, one is served at every inn upon English ware. Spain, Portugal, and Italy are supplied with it; and vessels are loaded with it for the East Indies, the West Indies, and the Continent of America.'"—Vol. ii. p. 121.

The long section on the "Cotton Manufacture," of course is full of interesting details: among others, we have a specimen of the way in which the talent of useful invention is rewarded in America. The story of Eli Whitney, the inventor of the cotton-gin, is not unknown already to the readers of the *Mechanics' Magazine*; they are aware that his patent was invaded with perfect impunity, and that he died without any adequate reward for his wonder-working invention; but even they may be surprised to learn that its effects have been so astonishing, in producing the exportation of cotton, which, without the machine, would have been useless; that, according to Pilkin's American Statistics, it has produced to the countrymen of the persecuted and unrewarded inventor, a clear profit of *two hundred millions of pounds sterling!* The fact seems incredible, but then it must be borne in mind, that all the statistical details of the Cotton Manufacture are of colossal dimensions.

It will be perceived that, notwithstanding the space Mr. M'Culloch has devoted to the subject, his chapter on "Manufactures" is far from being complete. There is one, of considerable importance too, and with which our author is practically acquainted, which we are surprised to find omitted; we allude to "Book-making." It is true, we have a section on "Paper-making," but the rest of the literary arts (author-craft among them) are passed over in silence. This is not as it should be; the statistics of literature ought to have occupied a very prominent place in such a work, more especially those of the Periodical Press. In these times, it is hardly pardonable to make no mention of "the fourth estate," in a production which aims at giving an idea of the condition of the people. Here are many other remarkable omissions in this division of "Manufactures," or rather, perhaps, a whole division has been omitted, which should have been given

on the more common Trades and Handicrafts. Every body in the kingdom must be lodged and clothed, somehow or somewhere, yet we have no sections dedicated to either of the arts of building, or of tailoring, highly important and indispensable as both of them are; and it is the same with almost all the other most familiar and most useful trades.

COLONEL MACERONI'S GALVANO-MAGNETIC THEORY OF THE UNIVERSE.

(Continued from p. 110.)

Capillary Attraction, Gravitation, Chemical Affinity, &c. &c.

Sir,—Illness has delayed the continuation of my hints on the galvanic or magnetic theory of the universe. In my last letter I was proceeding to say that a fluid medium, tranquillity, heat, and the magnetic combination or duality, are necessary, and are the cause of the development of all animal and vegetable life and organisations. But before I enter on that subject, I find that it is incumbent on me to say a word on the word *gravitation*, which I see I have omitted to do in the foregoing cogitations. The immortal Newton has demonstrated the movements and the respective actions and re-actions of the globes composing our solar system, as depending on a law which he calls gravitation. But I think it must be allowed, by all free inquirers, that the word so used is but a word, without any definition of the means, physical parts, action, or power which actually impinge, push, or draw in the operation. Newton himself tells us, that no body can have any action, or exert any force upon, or cause any motion in, another body, except through the means of some physical agent in contact with and communicating between the two. What, then, is this *gravitation?* What the *matter?* What the *modus operandi?* How does this "attraction" and "repulsion" between suns, and planets, and satellites, act in opposite directions at the same instant of time? for so it must, according to the Newtonian word and demonstration! When we are told that two positively impinging, drawing, repelling, mechanical actions or powers, are constantly in operation between two bodies (the sun and our globe, for instance) on the same line and in contrary directions, we certainly ought to be informed of the nature, the *matter*, and derivation of that *substance* (for substance it must be which acts upon substance), but which is no ways indicated by the mere word *gravitation!* It cannot be denied that the phenomena of the solar and planetary movements are well accounted for and calculated, through the agency of the *cause* called gravitation. Still it is but *a word*, until we look for a meaning, which I think will be found in *the expansive emanations from the infinity of globes, acting upon each other as above predicted.* It is evident that the universe is sustained and governed by *force;* and this, not only in every existence and action, which we call "physical," but also in the things and relations we denominate "moral." And there can be but one law for all things, as there is but one substance. The substance is the substance of the suns, stars, and planets, which I have briefly endeavoured to show is the same as that of animals, plants, minerals, fluids, gases, electricity, magnetism, galvanism, light. The *force* deciding the modes and motions of matter is that eternally inherent to the nature of matter. This has been called gravitation. We may give it what name we please, but its absolute *nature* was not stated by Newton, who allows that it must be a *substance*. I have endeavoured to show, that with respect to the primary formations or globes, it is the radiating perspiration of each, reciprocally impinging on all surrounding ones.

Chemical affinity is nothing more than another exhibition of galvanic or magnetic action. All bodies which we may bring into contact, are either in a similar magnetic or galvanic state, or they are in different states. In the first case, they have a mutual indifference to each other. If the substances which we place in intimate contact, or mixture, are in a different state of electric action, and that such difference be simple and harmonious, like that of the major and the minor fluids of the electro-motive apparatus, or the magnetic bar, that is, as 1 is to 2, 2 is to 3, an harmonious electric arrangement or galvanic superposition takes place between the substances, as between the two poles of the electro-motive apparatus, mutual infusion; multiplied contact; rapid electrical combinations are formed, which crossing each other in

every sense, *set free a quantity of the major and the minor elementary fluids, which, regaining their expansive liberty, produce heat and sometimes light perceivable to our senses.* The produce of such a chemical union is a compound of increased density and hardness, in which there now is neutralisation and uniformity of electric condition. This process of mutual infusion, disengagement of heat, mutual neutralisation, and the faculty of new combinations, or *supercompositions*, if I may so call them, is especially illustratable in the union of *alkalies* with *acids*.

The chemical action is easy and prompt alone in substances that are in a liquid state, which alone can enable the molecules to place themselves in numerous points of contact. Solid bodies, even in a state of powder, are far from having this power of intimate contact. A fluid can, however, touch, and, as it were, embrace a solid; and the latter, upon being withdrawn from amidst the former, will be either wet or dry. If it be wet, that is, if its surface be covered with a number of the molecules of the liquid, it is a proof that there has been magnetic gravitation between its substance and currents, and that of the liquid. If, on the other hand, the solid comes dry from the liquid, mutual repulsion has taken place. These facts, which accompany the emersion of a solid into a fluid, appear to me as explanatory of what is called *capillary attraction*. Water wets glass, and will be seen to rise upon its perpendicular surface. The water and the glass are equally solicited by the mutual gravitation. The water alone is capable of motion. The surface alone of the glass can be affected by the contact. The cavity of a small tube is nearly all surface, and the more so, in proportion to its smallness. The water rises in the tube. On the other hand, water and fatty substances repel each other. Grease the inside of the glass tube, and the water will be depressed below its own level within its cavity instead of rising. Mercury does not wet, or attach itself to glass; it consequently descends in such a tube, but it will rise in tubes of gold, silver, copper, or tin. Capillary action is only an attempt at a chemical action or combination of galvanic sympathy.

This part of the subject alone would require a volume, so I will only add another remark or two, as an index to those who may be inclined to meditate upon the few hints which I have space to furnish. The immediate cause of the election which the molecules of liquids make of each other, when their relative electric conditions are in harmonious relationship, appears to be the following:—All the electric fluids, already spoken of, whether they be of the major or the minor order, *i. e.* positive or negative, consist of elastic globules. Caloric, which is a uniform mixture or equilibrium of the electric fluids, is eminently elastic; upon impinging upon any body, it is reflected with vigour and regularity, according to the mechanical laws of motion. Now I have already suggested, that all elastic globes are in a state of constant vibration. It is therefore according to the universal law of equilibrium that unions are more readily formed between the elastic globules or gases, the vibrations of which approach to uniformity. Two elastic globules of different origins cannot possibly vibrate in a more analogous way than those of the oxygen and hydrogen gases, which I have already shown are the electric relation of double the mass with one vibration, and half the mass with two vibrations. In proportion to the more or less accordance in the vibrations of globules to mathematical simplicity, is the frequency and facility of chemical combinations. Discord, disorder, repulsion, prevent the union of globules which have no agreement in their vibrations. They must fly away and seek their affinities and their place,—which they are sure to find somewhere in space.

The phenomena of *sound* are very closely dependent upon the foregoing conditions and constitutions of matter. Liquid bodies produce no sound, except by impingement on the air, which is an assemblage of elastic globules. Elastic solids emit sound upon being struck, and, under certain circumstances, *without* being struck, as a metal wire stretched between two posts in the open air, will give forth sounds independently of any impingement, either of a solid or of the air. The sound emitted by an elastic solid is part and parcel of the sounding substance; elastic globules belonging t its most intimate substance, take their flight in convulsive movements successive, equal and regular. The sonorous

particles may well be said to be *squeezed* out of the sounding substance, by the percussion and the consequent agitation. The analogy between the globules of sound and those of the electric or galvanic fluid, are most striking in their action in vacuo, and, indeed, in every other way, including the laws of chemical affinities and even of animal life. But I must leave my remarks on this interesting subject to another and more especial disquisition. By-the-bye, I have often been struck by the singular humming, buzzing, singing noise with which we are assailed upon plunging over head and ears in water, and particularly in diving to a considerable depth into the sea. Through the aid of a heavy iron weight, I have plunged to the bottom of the sea, to a depth of eighty-six feet. On such occasions, the internal noise I allude to, is particularly loud and various. Now I am inclined to attribute it to the different motions and frictions of our muscles, blood, heart, intestines, eyes, and even brain, giving out different sounds which are compressed and concentrated by the surrounding and superjacent waters.

A general and precise definition of what is *life*, is not just yet within our power,—from the most complicated organisation of the human frame, to the simple moluscæ, worms, sickness, fungi, &c.

ON THE SOURCE OF ELECTRICITY AND ITS ACTION ON PLANTS IN THEIR MATURING PROCESS.

Sir,—In what has been advanced by me upon the subject of *electro-vegetation* in your pages, I trust it will have been perceived that there has been a constant endeavour to avoid mere theory, and to build as much as possible on facts. Still as several general positions have been stated which differ, in terms at least, from those which have been laid down in treatises, and as some of them cannot pretend to a higher support than that of *probability*, I feel that in proceeding to such considerable lengths, I am treading on tender ground. But I write under the persuasion that truth, or some near approaches to it, ordinarily presents itself under the form of probability, before it can have been sufficiently investigated to determine its certainty; nor can I help thinking that as human nature is ever prone to extremes, so that of caution in the bare announcement of facts, without attempting to advance a step farther than the facts seemed absolutely to demonstrate, has imposed a restraint on the bounds of probable truth, which has operated to some extent in precluding the steps towards its more certain and exact attainment. This restraint upon the operations of the mind seems moreover to have been attended with another unfavourable result of an opposite description; for its propensity to generalise, breaking through its preternatural bonds, appears to have led to several hasty conclusions, both of a negative and positive description. Thus it has been laid down as so many established positions, that light, heat, and *electricity*, are *not* different *effects* or *phenomena*, attendant on the operations of one imponderable, all-diffusive, fluid, but of three or even four different fluids of this description; although it cannot be denied that they are frequently observed under circumstances of such intimate connexon, that they have *every appearance* of proceeding from one uniform cause. Indeed, it seems next to impossible to observe the powerful electrical effects resulting from the arrangements of a galvanic battery, accompanied with a corresponding intensity of heat, and a light more nearly approaching that of day than can be produced by any other artificial means, without concluding, for the moment at least, that they are different effects produced by the operations of the same fluid, which is thus drawn from its general diffusion through gravitating matter, and concentrated to one spot. In like manner, when we observe light and heat issuing from the sun, and diffused through the atmosphere under every appearance of a common result of the same fluid proceeding from one source, we seem almost unavoidably led to the inference of their common origin and nature. We do not, indeed, find them always united, at least in an equal degree; but may not this circumstance admit of an easier explanation from regarding them as different effects produced by the same fluid in whose operations they are so often seen to be closely united, than by viewing them as absolutely separate and distinct in their essential properties? Do we not often perceive light becoming *latent*

under the form of caloric, and again set at liberty in the form of both light and heat? We do not observe electrical effects to be the usual or very frequent effects of the fluid issuing from the sun; but a dry air, over which the sun's rays are dispensed, is now well known to be in a constant state of positive electricity. The air, in its relation to the sun, may justly be compared to a great electrical machine, which is constantly receiving its supplies from above, and either imbibing them into its substances, or transmitting them to the earth and its vegetable productions, through the medium of those exquisite conductors with which they are furnished. That these effects are so little open to our observation is not because electricity, or the fluid by which it is produced, is not very extensively dispensed in nature, has recently been shown in a striking manner by that ingenious practitioner,* who has collected it in such formidable and effective states by means of wires extending through the atmosphere. But whereas the efforts of art are directed to collect it at particular spots, those of nature are almost uniformly directed to the opposite purpose of dispensing it in those regular and nearly imperceptible quantities, which are at once essential to maintain the existence and preserve the harmony and tranquillity of the system. It does appear with considerable evidence that *light*, *heat*, and *electricity*, are continually dispensed into our atmosphere from that great central body, which is perhaps equally necessary to the repellant as to the gravitating properties of the planetary bodies. It is surely evident that, since myriads of conductors fitted to imbibe electricity from clouds at elevations on which metallic points can have no influence, every where shooting up from the surface of the earth, are insufficient to prevent a constant state of positive electricity in the atmosphere, supplies of this fluid must be as constantly administered to it from above as of light and caloric; and from whence can these continual supplies of electric matter proceed but from the same common source? But that divine skill which regulates the quantities and manifestations of light and heat, and of the principle of expansion in those proportions which are requisite or conducive to life and enjoyment, is applied in causing the *electrical* operations of the same fluid to proceed almost imperceptibly in producing many other effects, no less essential or conducive to the same results.

There is reason to believe that the third and concluding process of vegetation to which we shall now immediately attend, is influential in a far greater degree in carrying forward this design than either of the preceding processes. As the solar beams increase in number and intensity, vegetation advances; its branches extend and send forth innumerable ramifications, and its leaves, in a manifold greater numeral proportion, expand into palmated shapes of a porous structure, fitted for the reception of immense quantities of light, and furnishing continual supplies of water, which, by combining with it in the state of transparent vapour, neutralizes their action, and makes provision for a sheltering canopy over our heads, adn for a seasonable supply of moisture both upon the soil and plants. As animal life also of every kind is now rapidly advancing, and oxygen gas is by the action of the respiratory organs rapidly exchanged for carbonic acid, the leaves of plants appear to be now constantly engaged in the function of absorbing this deleterious gas, which, with the returns of light, is reconverted into pure oxygen air; and thus another great and essential benefit to both the animal and vegetable systems is effected. The presence of carbonic acid is essential to plants; "it has been ascertained that feed plants, as you will, they *will neither grow nor live*, whether you offer them oxygen, hydrogen, or azote, or any other gaseous or fluid principle, *unless carbonic acid is present*."† It is evidently decomposed by the action of light, the carbon remaining in the substance of the leaves, or uniting with the descending portion of the sap, while the oxygen retaining the gaseous form is restored to the atmosphere.

I flatter myself it will have appeared from the above and the foregoing statements, that the three processes which have been assigned to vegetation, corresponding with the principal elements of the atmosphere, are attended with considerable evidence. If its action in each of these processes is electrical, in proof of which,

* Andrew Crosse, Esq.

† Prout on Chemistry, p. 451.

facts and experiments have been adduced in each instance, it appears to follow that electricity is the great principle by which vegetation is carried forward. And as they apply severally to air, vapours, and light, they manifest the existence of this principle in each of those elements. Now, if it is found floating in an uncombined state in the air; if by its being extracted from vapours they are reduced to a liquid state; and if in the form of light, it performs the galvanic effect of decomposition, is not strong direct evidence afforded that the same *solar fluid* is manifested under the three forms of light, heat, and electricity? If this be admitted, it appears to me that considerable light will be thrown upon this system of nature, and the relation between plants and animals. The sensible effects of electricity are in general disagreeable and injurious; they are, however, we conceive, no other than the effects of the solar fluid floating in a state of separation from gravitating matter, and seeking to obtain an equable diffusion among its particles. A small quantity of it alighting on *solids*, especially if they be non-conductors, quickly assumes the form of electricity, as it cannot enter their pores and separate their closely united particles with sufficient facility to become latent within their substance. If in the form of light it strikes the surface of water, it easily combines with a small portion of it in a state of vapour; and its electrical properties are thus neutralised. By impingeing upon the earth, and being reflected into the atmosphere, a greater or less degree of electricity is probably produced, especially if the surface of the earth is dry; but the effect is greatly alleviated by the readiness with which the air, in common with all gaseous bodies, opens to receive the fluid in the form of a moderately increasing temperature and rarefaction. According to these views, there is an increasing necessity for *neutralising* the action of the solar beams to a certain extent; or of diverting their operations from the forms of light, heat, and electricity, as the summer season advances, to some other necessary and useful purposes. And these purposes appear to be effected by the increasing foliage of plants. The moisture upon the surface of the soil being quickly evaporated, there is the greater necessity for that copious supply of moisture which is constantly yielded under the action of light from the leaves and even the green stems; and every particle which is thus rendered latent in the form of aqueous gas, diminishes the quantity of sensible heat and the glare of light which would otherwise remain in the atmosphere.

But we also find that a process of greater and more absolute necessity, both to the animal and vegetable systems, is going forward at the same time, though in a less perceptible and more gradual manner, by means of a similar action of the solar beams upon the carbonic acid, of which these organs are the constant absorbents. It is by means of these concurring properties of the leaves, and of the light acting upon them, that we are enabled to account for a large portion, at least, of the carbon which we find entering into the substance of plants, and of the oxygen gas by which the vital principle is maintained in animals. It is an observation of Sir H. Davy, that we know of "no process in nature by which the carbonic acid formed during fermentation, combustion, putrefaction, respiration, and a number of operations taking place on the surface of the earth is destroyed, but by vegetation."* "When," he observes, "a growing plant, the roots of which are supplied with proper nourishment, is exposed in the presence of solar light to a given quantity of atmospherical gas, containing its due proportion of carbonic acid, the carbonic acid, after a certain time, is destroyed, and a certain quantity of oxygen is found in its place. If new quantities of carbonic acid be supplied, the same result occurs; so that carbon is added to plants from the air, by the process of vegetation in sunshine; and oxygen gas is added to the atmosphere. This circumstance is proved by a number of experiments made by Drs. Priestley, Ingenhoiz, and Woodhouse, and M. T. de Saussure, many of which I have repeated with similar results." I have been induced to add these extracts from Sir H. Davy's observation in conformation of my former statements, both on account of the importance of the principle they advocate, and the beautiful harmony which it presents between the functions of plants and animals, and because it still appears a prevailing opinion of physiologists, that vegetables are almost identified with ani-

* Agricultural Chemistry, 4th ed. pp. 194 and 203.

mals with regard to their respirative and their digestive functions. In page 453, of the same work, from which the above short extract on the necessity of carbon to the growth of plants is made, it is said, on the authority of Professor Burnet, that the process of respiration in plants is supposed to be continual, and to be accompanied, as in animals, by the formation and emission of carbonic acid gas." It is admitted, however, that during their exposure to the light of the sun, the decomposition of this gas from the atmosphere, and the absorption of the carbon from the acid is effected. In other words, carbonic acid is removed from the atmosphere, and oxygen gas is produced. It is surely an extraordinary "*supposition*" that plants are *giving out* carbonic acid to the atmosphere at the same time, and under the same circumstances, in which it has been *clearly proved*, that they are effecting its removal. But this last is ascribed to "the process of digestion" in plants; whereas a separate process of respiration, it seems to be taken for granted, must also be carrying forward; but to identify plants with animals, and from that hypothesis to make a supposition in opposition to a fact clearly proved and admitted, is a mode of proceeding not very congenial with the true spirit of philosophy.

We trust it has been proved that plants, instead of continually emitting carbonic acid, are imbibing it by their leaves as continually as it is exposed to their action; a process which indeed seems essential to the aggregation of that large proportion of carbon which enters into their composition; and with which the supposition of their being subjected to the continual loss of carbon by an opposite process is utterly irreconcilable. In truth, the analogy, or rather identification, which is sometimes represented as existing between plants and animals, with respect at least to their digestive and respiratory functions, appears to have much less foundation in reality than has been imagined. What strong marks of resemblance are there between the most perfect of the orders of animals, and the most perfect of the vegetable tribes? Or with what degree of correctness can the favourite comparison between the lungs of an animal and the leaves of a plant be maintained? The former are admirably constituted for the purpose of admitting large supplies of air into their expanded vesicles; of receiving from it that supply of caloric which is necessary to the uniform heat and vitality of the animal; and at the same time, of transmitting to the oxygen a portion of carbon, which, if retained in the blood, would impede its circulation. The leaves of plants, on the contrary, from their origin in buds to their full expansion, manifest no such property. In proof of this position, I have made several experiments with seeds growing under the receiver of an air-pump carefully kept in a state of exhaustion; from which I think myself fully justified in the assertion, that cresses and mustard-seed at least will germinate, grow, and flourish, in a state of exhaustion, in which any of the more perfect orders of animals, those especially which live by means of well-developed organs of respiration, would almost instantly perish. We have in the foregoing papers endeavoured to show that plants derive the vital principle not by a respiratory process, but by that electric action on the air and vapours for which their whole structure, and particularly their pointed and edged extremities, are so admirably calculated. This property they no doubt continue to exert so long as they retain these conducting organs in a state fitted for action; and the enlargement of the plant with its increasing foliage must extend its electrical influence. But as the growing stage of its existence passes into that of maturity, we have seen that a different process is going forward to an increasing extent; the leaves become fully developed, but we repeat our statement, that from every observation we have been enabled to make, as confirmed by those of the great names to which we have appealed, these effects with respect to carbonic acid are the reverse of those which are produced by animal respiration. In my fourth letter on *electro-vegetation*, I have stated the experiments by which I unexpectedly was led to the conviction, that leaves imbibe carbonic acid with avidity in the absence of light, and during the night season, and which, as they consist simply in placing leaves, or sprigs of leaves, whether on the trees, or immediately after they have been plucked, in water or air containing a small quantity of carbonic acid, too large a quantity proving deleterious, can easily be re-

peated. It being also known that they perform the same function under the action of light, when oxygen gas is extracted, the conclusion appears indubitable that the function of the expanded leaf is, in this respect, *the reverse of that of animal respiration, consisting in the absorption of carbonic acid, both by night and day; while under the influence of light it emits pure oxygen gas to the atmosphere.*

If the principles which we have advocated be founded in fact, vegetation is, in every point of view, and by means of its several effects upon the surrounding elements, conducive to the existence and welfare of the animal creation. It derives its vitality from the same solar fluid as that by which the animal heat and life is maintained. But it is drawn by elastic action from those portions of it which floating on the air, or set loose by condensing vapours, would otherwise either augment the quantity of electricity or of heat in the atmosphere in excessive degrees. Carbon, forming a large portion of its nutriment, and an essential of its existence, is imbibed by it in its connexion with oxygen apparently in a like proportion to that in which it is given out by the several opposite processes, and in particular by animal respiration. By this process, in connexion with that of evaporation, it is eminently conducive to the existence and well-being of animals, during the period of its greatest vigour and luxuriance; as by these means the solar fluid is combined with oxygen in a state of fitness for maintaining their vital principle; or by combining with water, a cooling shade is formed in the atmosphere—and by both these processes, but especially by the latter, great quantities both of heat and of electricity are prevented from accumulating in it.

In the forming of these conclusions, facts have either preceded or gone hand in hand with theory; but I hope that many of your readers will concur in the sentiment, that the harmony and coincidence of the parts tends considerably to confirm the credibility of the general results. Upon the principles we have advocated, vegetation stands in a corresponding state of subordination and subservience to the animal system as it respects the means of vitality, and the general temperature and tranquillity of the atmosphere, that it does to the means of subsistence, comfort, and enjoyment in other respects. As it produces compounds from bare elementary bodies suited for the food of animals, so it produces a compound of air exactly suited to their respiratory organs. And thus, in a scale gradually ascending from elementary and inorganised matter, the inferior orders of beings and of substances are made subservient to the higher.

T. PINE.

PERPETUAL MOTION.

Sir,—From the tone of Nautilus's reply, I am afraid he is losing his temper. If he be really in search of truth, he will succeed all the better, I think, by proceeding coolly, and his observations would have more weight too, if he were to deliver them in language a little more respectable than he has employed in his last. He says, "as for the assertion that Kinclaven has been knocked on the head with the lump of lead on the arm of the fly-wheel, I leave it to himself to deny it; I can find no marks of the *dent* in any of his letters." Now it may be true that Nautilus cannot perceive the dent, and yet there may be a very deep dent, notwithstanding; all persons are not gifted alike with the faculty of perception, and, as he very candidly confesses his dulness, it may not be thought uncharitable to give him a little aid on this occasion. Well, Nautilus, Kinclaven commenced his attack upon the electrical theory, by announcing, in the most confident terms, that the Newtonian system had been rigidly demonstrated, and that therefore the electrical theory must be false. He was meekly reminded of two propositions that have not yet had the benefit of any demonstration whatever, although they happen to be the very two upon which the whole system depends, and was respectfully solicited to supply this deficiency before he said any more about the "rigid demonstrations." Kinclaven, finding himself in a somewhat awkward predicament, has very kindly referred me to the parson for one of the demonstrations, which he says is to be, not of the mathematical, but of the orthodox kind; as for the other, Kinclaven keeps it in *imo pectore*, as Nautilus says, in reference to the perpetual motion problem. Here then, Nautilus, are *two* very plain dents, but if they are still imper-

ceptible to your mental vision, I am afraid you must remain in darkness, your case is hopeless.

Nautilus and Trebor Valentine little imagine, I presume, that the same argument that they have advanced to show the absurdity of expecting a perpetual motion from the wheel and magnet, may be applied with almost equal force, to show the absurdity of the Newtonian system. Let us try what a little transposition will do.

"How then can it be expected, gravity being powerful enough to restrain the earth, and keep her in her orbit, thereby *nullifying* the angular velocity, that the said velocity is to remain for ever *unnullified*."—*Nautilus.*

"It must be plain to every one, that the momentum, the very power which is said to give motion to the earth and planets, is completely neutralized by the power of gravity."—*Trebor.*

There, Nautilus and Trebor Valentine, you see that you have unwittingly given the electrical theory a "pretty considerable lift," for which I beg to offer you my most humble thanks; and in your future meditations upon the "great problem" of the wheel, you will take this consideration along with you, that when you have succeeded in proving its absurdity, you will at the same time succeed in proving the absurdity of the Newtonian system; after which happy result of your deep cogitations, it will be found that the electrical theory is not so very absurd as some wise folks have supposed.

I am, Sir, &c.

T. S. MACKINTOSH.

PRODUCTION OF LIFE BY GALVANISM—ANIMATION OF HORSE HAIRS!

Sir,—I have been delighted and overjoyed to see in your last Number (705), Mr. Crosse's account of the production of living animals by the judicious combinations of water, mineral matter, another galvanic fluid. I look upon this, as a clear experimental proof of the truth of the theory which I have been inculting for the last twenty years, which is the identity of all *life*, with the electric, galvanic, magnetic, or solar substance. In Number 401, p. 98, of the *Mechanics' Magazine*, your readers will see, that in speaking of the vital rudiments and "phosphorescence" of the sea, I use these words, "I mean, that the vitality and electricity, the electricity and vitality, are one and the same thing."

In the course of my observations on the electromotive theory of the universe, I shall come to an explanation of the *modus operandi* in the progression of the galvanic particles into vegetable and animal existence.

I also endeavour to account for the plague, yellow fever, and similar epidemics, on analagous principles; principles, in fact, which are now beginning to be applied to the "dry rot" in timber.

In 1818, I communicated my galvano-electrical ideas to an acquaintance of great philosophical acquirements, and requested him to try the experiment (as he had the necessary apparatus) of placing a fresh pulled horse-hair in a glass vessel containing pond water, exposed to the sun, and keeping a constant current of galvanic fluid passing longitudinally through the horse-hair.

Very shortly afterwards, I had occasion to go abroad, but I met Dr. Foster some time afterward, and he assured me that at the end of three weeks' submission to the galvanic influence, the hair had increased to the size of a thick straw, and gave him satisfactory proofs of real identical vitality.

I do not well remember how the business ended, but I recollect that he attributed the subsequent death of this his first-born, to the ligatures with which he had attached it to the wires. He promised to repeat that experiment, and others on different substances and infusions. But he shortly after went to Scotland, and I have heard is now practising with distinction at Edinburgh. I hope he may see this.

Many people have all along called *me* insane, in consequence of opinions on vitality, the identity of all matter, &c., partly set forth in Numbers 400 and 401, and now intended to be more developed in the series of articles I have recently sent you. Perhaps Mr. Crosse will not disdain to try the horse-hair. I shall, and other things too, when I can get an electromotive apparatus.

I am, Sir,

Your obedient servant,

F. MACERONI.

THE BIRMINGHAM SEVENTH HALF-YEARLY REPORT.—REMARKS.

The publication of this Report has produced a great sensation in what may be called the railway world, and combined with the general depression which has lately prevailed in the money market, and consequent distaste for enterprise and speculation, has exercised, and, we fear, is still exercising, a most injurious influence on all railway projects. Whether the facts which it discloses are of a nature to warrant such a decline of confidence in the railway system, becomes therefore a subject of earnest inquiry—to all, at least, who think with us that there is more good to come to the country from the rapid and general adoption of that system, than from any other class of public undertakings whatever.

The grand fact promulgated by the Report—that which is in every one's mouth, and is disquieting and unsettling the minds of not a few—is, that "the contemplated works for the efficiency of the railway in the carrying department, as well as for the road itself," will require a sum of nearly two millions more than the sum originally estimated to be requisite. Certainly this is a large excess; but before we leap to the conclusion (as is the fashion of the day), that we should therefore cease to have any faith in the safety and the eligibility of this or any similar undertaking, as a means of pecuniary investment, there are two preliminary questions which ought in all fairness to be carefully examined and disposed of (if so they can be) in the negative.

First. Is the excess accounted for on just and reasonable grounds?

And, *second.* Will this excess increase the total expenditure to so disproportionate an amount that the railway will no longer yield an adequate return to the shareholders?

I. Now with respect to the first question, let us see how the excess is stated in the Report to have arisen.

"*Land and Compensation.*"—The Parliamentary Estimate under this head was 250,000*l.*; the actual cost has been 506,600*l.*—more than double. The promoters of the undertaking had, we dare say, calculated, that the owners and occupiers of the land required for the railway, would, in consideration of all the rest of their estates being incalculably improved in value by its passing through them (to say nothing of the higher and purer consideration of the public good), have been content to accept of the *actual* value of the land taken from them, and a fair compensation for the *actual* loss otherwise sustained by them; or, at all events, with the double of such actual value and double compensation for such actual loss. Nay, perchance they may have even fancied it not without the limits of probability, that some of the more distinguished of these *persons for* wealth and station—noblemen and gentlemen, for example, with vast landed possessions and more than princely incomes—would have public spirit enough to make the undertaking *a present* of the few paltry acres required from them. Instances of such enlightened liberality have not been rare in railway cases on the other side of the Atlantic; and it may have been supposed (fondly, at least, however erroneously,) that the flame of patriotism still burns as brightly in the old or father-land of the English race as in the new. Certain, at all events, it is, that the Parliamentary estimate for land and compensation must have exhibited the *full* amount, which, in the judgment of competent persons, *ought* to have been paid under this head; for it is only upon evidence to such an effect and of such a character, *given too upon oath*, that the Bill for the undertaking could have passed the Upper House of Parliament. But all these reasonable calculations—these valuations on oath notwithstanding, we find the *actual* has been more than double the *estimated* cost? And whose fault is this? Not the Company's assuredly. The Directors state that they have been obliged to purchase 800 acres of land more than they laid their account with, and that the much higher price which they have been "compelled to pay," for it was, "*in some degree*, extorted by the necessity of obtaining possession at an earlier period than by the provisions of the Act of Incorporation the Company could legally enforce." But *how else* extorted, they do not say; and for not speaking out a little more boldly, are, we submit, much to blame. We think the justice of the case demanded a full exposure of *all* the extortion to which they have been subjected, through *all* its degrees of enormity.

We shrewdly suspect that if *the whole* truth were made known, we should find there was extortion *both* as to the number of acres the Company were *compelled* to purchase, and as to the price they were *compelled* to pay for them —extortion as well on account of time of payment as of time of delivery of possession—extortion, in short, under every imaginary pretext, in every step of every transaction. Not a garden or pleasure-ground, we will make bold to say, has been encroached upon even to the extent of a hand's-breadth, without the Company being forced to purchase at an extravagant price, the entire garden or pleasure-ground, with whatever mansion houses, or other buildings might happen to be standing upon them. So destructive of all fitness for gentlemanly occupation is the proximity of a noble railway, on which vehicles worthy of all admiration as objects of art, and of incalculable benefit to the national industry, may be seen some ten or twenty times a day, gliding quietly but swiftly past—no sooner seen than gone! So grievous, forsooth, the injury inflicted, that nothing but gold, and more gold, and yet a little more, could compensate the unfortunate sufferers! Eight hundred acres beyond what was wanted! Why, this must be just about as much again as was required for the actual purposes of the railway,—eight acres per mile being about the fair average. The doubling of this head of the estimates is thus at once accounted for; the patriots of the landed interest have "extorted" from the Company double what they had any right to.

The extortion here practised is but a sample—not, perhaps, the worst that might be adduced—of a system which is unhappily too much in vogue with respect to railways in this country, and which, to our humble thinking, is an indelible disgrace to the times in which we live. Railway companies are by too many considered as only fair objects of plunder, and plundered they accordingly are with a vengeance. Why they should be so considered, it were hard to tell; unless it be that they are to be plundered on the same principle that Aristides was ostracised—namely, that they are things too good to be spared. Men of all ranks and classes have joined with equal avidity in this new species of public robbery; the only difference being that the higher and more influential the party, the greater the extortion. Judging from past experience, we should say that to "one of the quorum" an acre of railway ground is worth, at least, thrice as much as to any ordinary yeoman; to a gentleman of Parliamentary influence, full ten times as much; and to any lord, spiritual or temporal, so very much more than to any body else, that there is no measuring the enormousness of its worth, except by the latitude of conscience common to men of such high degree. Times there have been, when public prostitution so gross, as has been lately witnessed in this country in railway cases, would have been visited with its merited punishment—impeachment, expulsion, degradation, and infamy. Speak we untruly? Let any one who deems so, but procure a return to be made from the different Railway Companies of the various sums which have been paid, or engaged to be paid, during the last six years to Members of the two Houses of Parliament, or to the near relations of such Members, in the shape of price or compensation; and we shall fearlessly abide the issue.

"*Contract Works for forming the Road.*"—The excess under this head is 442,238*l.*, and the manner in which it has arisen is thus explained in detail by the Engineer (Mr. R. Stephenson):—

The first cause of excess is stated to be "*an increased width in the railway.*" How much this increase is, the Report does not state; but we believe it to be not less than four feet upon twenty-six. We believe, also, that we are right in assuming that this increased width has not been adopted from any conviction of its necessity on the part of the judicious and intelligent Engineer of the Company, or even on the part of the Directors, but from a prudential regard for the theory lately propounded by the Engineer of the Great Western Railway, that the only proper width for railways is 7 feet (instead of from 4 feet 8 to 5 feet), and the only proper diameter for railway-carriage wheels also 7 feet (instead of from 4 feet 6 to 5 feet 6) and from respect for the good opinion entertained of this theory in certain circles which are reported to exercise a great sway in all railway matters. Mr. Brunel *may* be in the right—all other railway-engineers in the wrong; and, therefore, it is good policy to be provided against the contingency! Other

railway-engineers, to be sure, have experience on their side, which Mr. Brunel confessedly has not; they have, also, the established principles of mechanical science with them in their adherence to past usage; but what of all that? Has not the new system been voted by a numerous public meeting of railway adventurers, held in a certain great town in the north, to be the only true system? And what tribunal so capable of deciding upon a grave scientific question like this as a miscellaneous public assemblage of merchants, manufacturers, tradesmen, shopkeepers, and the like? The truth to speak, the Birmingham Railway shareholders are made to run a much greater risk for this whim of Mr. Brunel's, and for the confiding credulity of his friends and admirers, than there is any good reason to justify.

The other items of excess consist of an "*additional outlay*," arising from the company's having been compelled to take up the contracts for the Primrose-hill, Blisworth, and Kilsby Tunnels, which were all "let below the revised estimate" (of the engineer), and then thrown on the Company's hands, "in consequence of the great and unforeseen (and in the cases of the Primrose-hill and Kilsby Tunnels *unprecedented*) difficulties which occurred in the progress of the works. The engineer cannot, of course, be to blame that contracts, which were entered into at prices below his own estimate, were thrown up; nor the Directors that they accepted the lowest tenders which were made to them by respectable and competent parties. As little would any reasonable person think of finding fault with the engineer or contractors for making no provision against "unprecedented" and *therefore* "unforseen" "difficulties." The only part of Mr. Stephenson's explanation on this head which we are not satisfied with, is that which relates specially to the Kilsby Tunnel, the excess in the cost of which he ascribes to "the occurrence of an extensive bed of quicksand lying over nearly one-fourth of the whole length of the tunnel, and requiring to be drained by powerful steam-engines, which must be kept at work till the completion of the contract; the other parts of the tunnel abounding in water, and rendering it necessary to increase the number of shafts to an extent which could not have been foreseen." The drainage requisite at this spot is, according to all accounts, quite enormous. The number of "powerful steam-engines" kept constantly at work for the sole purpose of pumping up the water being not less than sixteen; but why—we must take leave to ask,—"*could* it not have been foreseen?" Why was not the existence of "the extensive bed of quick sand lying over nearly one-fourth of the whole length of the tunnel" ascertained beforehand? Were there no borings made? And if not (as the lawyers say), why not?

"*Rails, Chairs, Blocks, Sleepers.*"—These articles are now estimated to cost 326,845*l.* more than was originally anticipated; nor will the reader be surprised at this when he is informed that the price of iron has risen in the mean while from 6*l.* to 10*l.* per ton, and that instead of rails weighing from 40 to 45 lbs. per yard, it has been found by experience that rails, weighing not less than 60 lbs. per yard, are requisite wherever (as in this case) heavy weights have to be transported, and heavy carriages (themselves, far more than an ordinary load,) have to be employed to transport them.

"*Stations and Carrying Department.*"—The Parliamentary Estimate was 80,000*l.*; the present estimated cost is 408,236*l.* This great difference is stated to arise "from the (more) ample provisions made for the carrying department, and particularly with reference to the traffic to be expected from *other railways*, for which Acts have been obtained since the estimate was made." The more tributaries to the main trunk, of course the more "stations" required; and the larger the "Carrying Department," the greater the requisite establishment of locomotive-engines, carriages, waggons, &c., and the greater the ultimate profit to the Company.

"*General Charges.*"—The excess under this head beyond the Parliamentary Estimate is 222,791*l.* No estimate of such a *generality* as this could possibly have any pretensions to accuracy; and but that the forms of Parliament required an estimate to be made, none would probably have been attempted. One of the heaviest items under this head is the "Expenses of obtaining the Act of Incorporation," 72,869*l.*; and it may reasonably be considered a matter of no small hardship, that so vast a price as

this should have to be paid for the privilege of adventuring some millions of money in an undertaking of such immense public benefit. The blame of this rests not, however, with the Company, but with the system of national polity that admits of such strange things—if system that can be called, under which the most important interests of a country are left to shift for themselves as they best can.

The total amount of the items of excess which we have now passed under review is 1,576,610*l.*; but to this there has to be added, 255,722*l.* on account of the Euston extension of the line, not at all included in the original estimates; making the entire difference between the original capital of the Company (2,500,000*l.*) and the present estimated cost (4,332,332*l.*) 1,832,332*l.*

Great as this difference is, and, beyond all question, deeply to be regretted, not only on account of this particular railway, but of all railways—we think it must be allowed by every one who attentively and dispassionately considers the explanations offered by the Directors and their Engineer—not excluding the aid of such lights as the preceding remarks may perchance have thrown over the debateable ground—that it is, upon the whole, of a sort that could not well be helped—is attended by many circumstances of a large compensatory character—and involves neither of necessity nor by fair inference a single solid objection to the railway system in general. However landowners may have been to blame for their rapacity, or the Legislature for its wilful blindness to the extortion and oppression practised by the money-changers within its walls, the Directors and officers of the Company have at the utmost this, and no more, to reproach themselves with—that they have in some instances yielded too readily to the pressure of external influences, and in others relied a little too much on the resources of art (mighty though they be) to overcome the difficulties opposed by nature to their progress.

II. The most material question (after all) still remains to be disposed of, namely, whether this railway, at the increased cost of 4,332,332*l.* is likely to yield an adequate return to the shareholders?

It is curious how studiously in all railway cases, questions of this sort are slighted by most of those who take an interest in railway matters (railway executives always excepted). Talk of any estimate of cost being doubled or trebled (no matter how excusably), and there is instantly a universal hubbub—"What a shame!"—"What a disgrace!"—"How disastrous!"—"How damning!" But take the obverse of the picture—let a report get abroad that the published estimates of revenue of any particular railway are some two, three, four, or any number of times below the actual truth (concealed, as the "actual truth" too often is, from a fear of startling public belief by proving apparently *too much*), and that instead of paying 5 or 10 per cent., as at first supposed, it will in reality pay 15 or 20—up go the shares instantly to double or treble the prices originally paid for them, and out go as many of the holders as prefer a bird in hand to two in the bush. One would think that there must be large room for thanks here, both from those who realise at once so handsome a profit, and from those who buy in with the hope of realising an equally handsome profit, only at some more distant day—that as the projectors of the undertaking are so unmercifully abused when the cost side of their estimates happens to be exceeded, so, on the other hand, they would be proportionally lauded when the profit side is in excess. But no such thing; every accession in the shape of profit or premium is considered as coming quite in the ordinary course of things, and pocketed in silence without thanks to any one. We have heard of some shareholders in this very Birmingham Railway, who, by selling out *one-half* of their original shares at a hundred per cent. premium, made a clear gain of the other half, that is to say, have paid not a farthing for them, and yet are the loudest in their complaints against the Directors and officers of the Company for the deficiency now made public. Could we but obtain an account of all the money which has been made by the sale of the shares of this Company, we feel confident that it would be found vastly to exceed the whole amount of that excess in the expenditure about which such an outcry has been raised. But we shall, perhaps, be told that one man's profit must needs

be another man's loss; and that those, at least, who bought at a high premium, have just reason to complain of being deceived and disappointed. In many instances the maxim cited is true enough, but it is wholly without application to a case like the present, where it is yet a question whether any loss whatever will be eventually incurred? If a person has purchased Birmingham shares at double their original price, he must have done so on the faith either that they would yield double the profit which was originally anticipated, or that the interest of the original holder was worth purchasing for twice as much as he paid for it. And having done so, he can hardly have any right to talk of deception and disappointment till circumstances arise (which we deny have as yet arisen) to justify him in considering all hope of his realizing the profit on which he reckoned as for ever gone. We speak here, of course, of such persons only as have bought with a view of permanent investment. As to mere jobbers and speculators, who have purchased shares for the sake of gambling in them, of such gentry we make no account; they have no right to be considered at all in a question of the sort now under discussion, doing always more harm than good by their intermeddling, and it being to them a matter of supreme indifference how the concern may ultimately turn out, so that they can but get *their turn* in the meanwhile.

The question, therefore, narrows itself to this—what amount of revenue may this Railway be expected ultimately to produce? According to the original estimates there was to be a net, or clear revenue of 369,346*l.*; but when we consider how many other railways that directly or indirectly will be tributary to this great inland trunk have started into being since these estimates were framed—that the Grand Junction Railway in particular, which is to connect the Birmingham with the Liverpool and Manchester Railway, is already on the point of completion, and that the great bulk of the Irish passenger traffic to the metropolis (for which hardly any credit was taken) must ultimately fall into this line, we are well warranted in reckoning that the real traffic will be more than double. Our own firm persuasion is (though of course we cannot expect to impart that persuasion to the reader without a much fuller exposition of causes and consequences than we have here time or space for), that the net revenue cannot fall much short of a million. Let us take it, however, at only double the first estimate, or say 750,000*l.*, and suppose the total cost of the line to amount to as much as 5,000,000*l* (which is certainly the outside of the possible cost), then the annual profit on the capital invested will amount to full 15 per cent.

In realising such a profit as this, the Birmingham Railway Company will be but following in the steps of its great predecessor, the Liverpool and Manchester. The original estimate of the Liverpool and Manchester Line was somewhere under 500,000*l*; the actual cost was close upon 1,200,000*l.*; and yet this notwithstanding, the revenue as such as to yield on the capital invested a net annual profit of 10 per cent. With such a precedent as this before them, the subscribers to the Birmingham Line may safely rest assured that they have nothing to fear from the worst that can now befal them in the way of expenditure. Not a reason can be urged in explanation of the brilliant success which has attended the Liverpool and Manchester Line, which does not go to justify the anticipation of a still more brilliant conclusion to the history of the Birmingham. The sources of revenue are much more numerous and ample, in the case of the Birmingham, than of the Liverpool and Manchester Line; while, at the same time, the sources of expenditure are by the great progress which locomotive science has made during the last six years, reduced to a point of economy, which, in the case of the older railway, with its unalterable allocation and gradients, we can never hope to see attained.

TUNNELS.

Report on the Primrose-hill Tunnel on the London and Birmingham Railway, by John Paris, M.D., Thos. Watson, M.D., Cantab., Wm. Lawrence, Esq., and R. Phillips, Esq.

We, the undersigned, visited together, on the 20th February, 1837, the Tunnel now in progress under Primrose-hill, with the view of ascertaining the probable effect of such

Tunnels upon the health and feelings of those who may traverse them.

The Tunnel is carried through clay, and is lined with brickwork. Its dimensions, as described to us, are as follows: height 22 feet, width 22 feet, length 3,750 feet. It is ventilated by five shafts, from 6 to 8 feet in diameter, their depth being 35 to 55 feet.

The experiment was made under unfavourable circumstances. The western extremity of the Tunnel being only partially open, the ventilation is less perfect than it will be when the work is completed. The steam of the locomotive engine also was suffered to escape for twenty minutes, while the carriages were stationary near the end of the Tunnel; even during our stay near the unfinished end of the Tunnel, where the engine remained stationary, although the cloud caused by the steam was visible near the roof, the air for many feet above our heads remained clear, and apparently unaffected by steam or effluvia of any kind; neither was there any damp or cold perceptible.

We found the atmosphere of the Tunnel dry, and of an agreeable temperature, and free from smell or perceptible effluvia of any kind; the lamps of the carriages were lighted; and, in our transit inwards and back again to the mouth of the Tunnel, the sensation experienced was precisely that of travelling in a coach by night, between the walls of a narrow street. The noise did not prevent easy conversation, nor appear to be much greater in the Tunnel than in the open air.

Judging from this experiment, and knowing the ease and certainty with which thorough ventilation may be effected, we are decidedly of opinion that the dangers incurred in passing through well-constructed Tunnels are no greater than those incurred in ordinary travelling upon an open railway or upon a turnpike-road; and that the apprehensions which have been expressed that such Tunnels are likely to prove detrimental to the health, or inconvenient to the feelings of those who may go through them, are perfectly futile and groundless.

JOHN, PARIS, M.D.

THOMAS WATSON, M.D., CANTAB.,
Physician to the Middlesex Hospital, and Professor of Medicine at King's College.

WM. LAWRENCE,
Surgeon of St. Bartholomew's Hospital.

RD. PHILLIPS,
Lecturer on Chemistry at St. Thomas's Hospital.

London, Feb. 21, 1837.

LIST OF SCOTCH PATENTS, GRANTED BETWEEN THE 27TH OF JANUARY AND THE 28D OF FEBRUARY, 1837.

George Goodlet, of Leith, merchant, for a new and improved mode of distilling spirits from wash and other articles, also applicable to general purposes of rectifying, boiling, and evaporating or concentrating. Sealed Jan. 25.

Charles Wheatstone, of Conduit-street, Middlesex, and John Green, of Soho-square, musical-instrument manufacturers, for a new method, or methods, of forming musical-instruments, in which continuous sounds are produced from strings, wires, or springs. Jan. 31.

Peter Spence, of Henry-street, Commercial-road, Middlesex, chemist, for certain improvements in the manufacture of Prussian blue, prussiate of potash, and plaster of paris. Feb. 10.

Miles Berry, of Chancery-lane, Middlesex, mechanical draftsman, in consequence of a communication from a foreigner residing abroad, of an improved apparatus for torrefying, baking, and roasting vegetable substances, which, with certain modifications and additions, is also applicable to the evaporation and concentration of saccharine juices and other liquids. Feb. 15.

John Gemmell, of Stockwell-street, Glasgow, merchant, for certain improvements in steam or other boats, or vessels, which are partly applicable to other purposes. Feb. 16.

Messrs Poole, of Lincoln's-inn, gentleman, in consequence of a communication made to him by a foreigner residing abroad, for improvements in anchors, and in friction rollers, to facilitate the lowering and raising such, and other anchors, which friction rollers are applicable to other purposes. Feb. 20.

James Cook, of Birmingham, gun-manufacturer, for improvements in gas-burners. Feb. 22.

NOTES AND NOTICES.

The First Russian Railway.—The locomotive carriages made in England for the Pawlosk Railway, do not appear to have answered *quite* so well at the place of their destination, as they are said to have done on experimental trips in the land of their birth. On the 22nd December last, some short journeys were performed on that part of the line already completed, for the express purpose of demonstrating the practicability of Railway travelling in the very depth of a Russian winter. On this occasion, the velocity did not much exceed twenty miles an hour: a very satisfactory pace, especially under the circumstances, but still something under the "seventy-five miles an hour" rate *reported* to have been attained in England: on another day, the result was not even equal to this, which is attributed to the wind's blowing against the line of direction; perhaps, therefore, it blew the right way on the experimental trips, under the direction of the builder. On the 22nd December, the apparatus for removing the snow from before the wheels was tried, and proved quite successful; from recent experience at home, it would appear that any apparatus for that special purpose is quite unnecessary.

Failure on Failure.—The Bombay mail, which was confided to Colonel Chesney to be forwarded home by the Euphrates route, has only just reached England, although sent from India so long ago as the 16th of September. It appears that it was found impossible to convey it by the Euphrates, and that

it was, consequently, sent across the deserts of Arabia to Egypt by a land-party, who were robbed and detained by the natives. It is needless to add, that the idea of effecting steam communication by the Euphrates line is now totally abandoned on all hands. The mail in question has been so long in coming, that it has been anticipated in its arrival by others of later date, both by the line of the Red Sea, and the old circuitous route of the Cape of Good Hope.

Consumption of Coal in Great Britain.—The quantity of iron annually produced in Great Britain may be taken at 700,000 tons; and the quantity of coal required, at an average, to produce each ton of iron, including that used by engines, &c. may be estimated at 5½ tons; giving a total of 3,850,000 tons consumed in the making of iron. According to Mr. Kennedy, the quantity of coal consumed in the cotton manufacture, in 1817, was upwards of 500,000 tons, and the manufacture has since more than doubled; so that, allowing for greater economy, we may fairly estimate the consumption of coal in the cotton trade at 800,000 tons a year. Its consumption in the woollen, linen, and silk trades cannot be less than 500,000 tons. The smelting of the copper ores of Cornwall consume annually about 250,000 or 300,000 tons; and it is supposed that the brass and copper manufactures require nearly as much. In the salt-works of Cheshire, Worcestershire, &c. the consumption is probably not under, if it do not exceed, 300,000 tons. The consumption in lime works may, it is believed, be estimated at 500,000 tons. It would appear, therefore, that the total annual consumption of coal in Great Britain may be moderately estimated as follows:—

	Tons.
Domestic consumption, and smaller manufactures	15,000,000
Production of pig and bar iron	3,850,000
Cotton manufacture	800,000
Woollen, linen, silk, &c.	500,000
Copper smelting, brass manufactures, &c.	450,000
Salt-works	300,000
Lime-works	500,000
	21,350,000
Exports to Ireland	750,000
Ditto to colonies and foreign parts	600,000
Total	22,700,000

If we suppose that the above sum of 22,700,000 tons costs the consumer, on an average, 7*s.* a ton, it will be worth, in all, 7,955,000*l.* a year!—*M'Culloch's Account of the British Empire.*

Cultivation of Filberts.—Sir, In consideration of the periodical return of the season for trying the merits of the suggestion I inserted in your Number 183, just ten years ago, for improving the crop of filberts, and as I have reason to believe from my own and other's subsequent experience, that my idea is well founded, you will perhaps allow the re-appearance of the following:—"In countries where figs are cultivated to the greatest perfection, particularly in Italy and Greece, a great augmentation, both in the size and number of the figs, is obtained by placing on the top of the tree a branch of the wild fig-tree (*Caprificus*), upon which have appeared male-flowered figs, which are the first to come forth. I have often thought, that the crop of filberts might be both ameliorated and increased, by a somewhat analogous application of a branch of the common hazle, when covered with the 'catkins' or flowers. This is just the time to try the experiment." I hope that some of your correspondents who have the opportunity, will try and report upon the experiment. Besides the increase of the pollen, it may have an effect like the ringing to the original stock by grafting or seed, as with apples and some other fruit-trees. Filbert-trees are often deficient in male flowers.—Yours, &c., F. MACERONI.

Colouring Alum Baskets—Query.—Sir, on referring to the previous volumes of your Magazine, I found a receipt to make alum-baskets, which I followed and found to answer. I have tried to colour the alum with the best ingredients dyers use; indigo and cochineal vanished in two or three weeks, and in all my attempts I have found the colours fugitive. Now I shall be much obliged, if any of your numerous correspondents will have the kindness to inform me, and the world (for your Magazine is read by every body), how I can give the alum a permanent colour.—P. B., and a Country Amateur. [P. B. will find a recipe for polishing granite in our 4th vol., p. 228.]

The Practical v. the Poetical.—Railway speculators have but little feeling for any thing so unsubstantial as poetical association. The Directors of the South-Eastern Railway have just horrified every admirer of "the bard of Avon" by advertising, in the most straightforward and business-like of all possible ways, for a contractor willing to undertake *the driving of a tunnel through Shakspeare's Cliff*, at Dover, hallowed as it is by the well-known and often-quoted passage in *King Lear*. Perhaps, after all, it may afford some consolation to reflect, that the present Shakspeare Cliff is identified in fancy only as the one described in the tragedy, and that there will be plenty left quite as high, although none with so peculiar and distinguished an appearance.

New Patent Law Bill.—A Bill "to amend the Practice relating to letters-patent for Inventions," prepared by Mr. Mackinnon and Mr. Baines, was to have been read a second time in the House of Commons last night (March 2). We shall give an abstract of it next week; in the meanwhile, we may remark that it is a commission job; and that though it simplifies the practice, it will materially increase the expense of Patents.

Errata in the Arithmetical Question of a Town Teacher in No. 706.—P. 400, line 1, after "per annum" read "on the principles of compound interest."

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised Caveats entered; and generally every Branch of Patent Business promptly transacted.

A complete list of Patents from the earliest period (15 Car. II, 1675,) to the present time may be examined. Fee 2s. 6d.; Clients, gratis.

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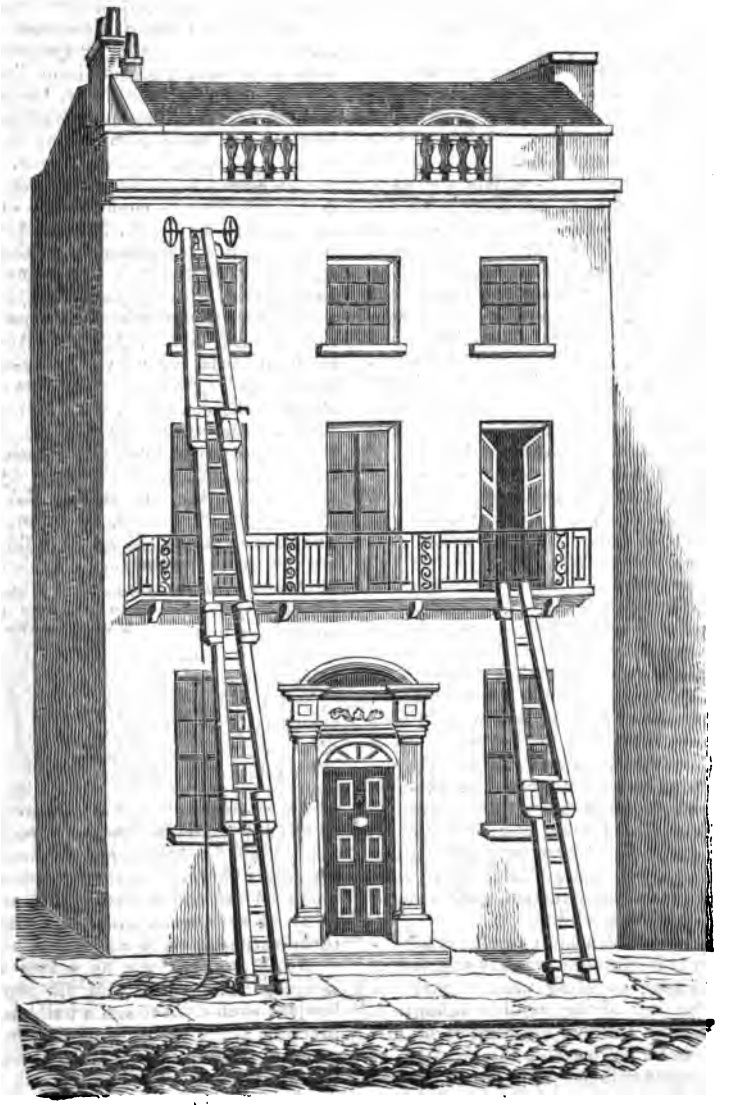
MERRYWEATHER'S PORTABLE FIRE-ESCAPE LADDERS.

Fig. 1.



MERRYWEATHER'S PORTABLE FIRE-ESCAPE LADDERS.

"Any fire-escape to be generally useful, must, in the first place, be capable of being carried about without encumbering a fire-engine; and, in the next place, must be of instant and simple application."—*Braidwood on Fire-Escapes.*

"The escape best adapted to accomplish so desirable an end should be simple in the extreme—flexible and portable—ever ready at command, and capable of being applied at the back of a house as well as in the front."—*Wivell's Lecture on Fire-Escapes.*

Sir,—In consequence of the melancholy and fatal fire in Tottenham-court-road, in December, 1835, at which four lives were lost, and several other persons narrowly escaped a similar fate, the inhabitants of the south-western district of St. Pancras formed an Association for providing and maintaining a fire-engine and a sufficient number of fire-escapes, to guard that populous neighbourhood, as far as possible, against the calamitous effects of fire. The gentlemen who were appointed Trustees and Committee upon that occasion, discharged the duties imposed upon them with great zeal and judgment, and they have the satisfaction of knowing that the example set by their neighbourhood has called forth a similar generous feeling in other parts of the metropolis; several parishes have sought the benefit of their experience, and by their advice have adopted similar precautionary measures. From present appearances, the beneficial results of these endeavours seem likely to be permanently diffused throughout the country. At the commencement of their labours, the St. Pancras Committee invited inventors to come forward by public advertisements. The models and plans that were in consequence submitted to the inspection of the Committee, were so exceedingly numerous as to render the task of examining and deciding upon their respective merits one of a very long and difficult character. Many extremely meritorious inventions were not available on account of expense of construction, and want of the requisite portability.

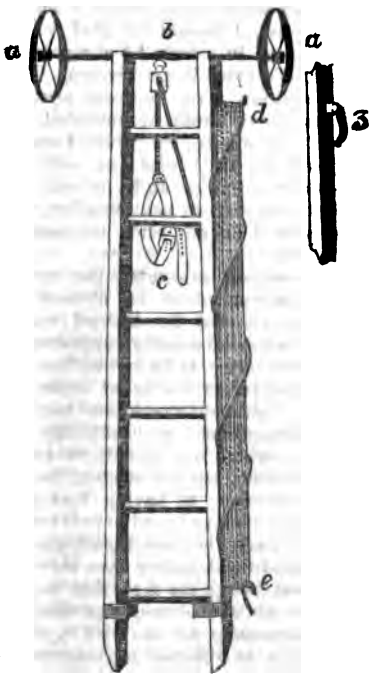
The result of a most careful comparison and investigation was the selection of *two* escapes, as being most unquestionably the best of the number submitted. These were the spar fire-escapes of Mr. Ford, and t he portable fire-ladders of Mr. Merryweather. The former invention I have already fully described at page 130 of your 25th volume, and I now propose to explain the peculiar merits of Mr. Merryweather's ladders, which have already been several times adverted to in your pages, during their progress towards their present perfect state.

The formation of a society for the protection of life from fire, in March last, has led to several further investigations into the relative usefulness of all the various methods of escape from fire that have been proposed from time to time by different individuals, which has had the effect of bringing forward several new, as well as of establishing the originality of many old, inventions. The ultimate result of all these inquiries, however, has been a confirmation of the choice made by the St. Pancras Association, and the establishment of the vast superiority of the two inventions they had adopted. One of the earliest parishes that availed themselves of the experience thus gained, was that of St. Andrew, Holborn, who have twelve fire-escape stations under the superintendence of the Police. Besides these, Mr. Merryweather's ladders have been adopted by the parishes of Allhallows, St. Sepulchre's, Greenwich, and several others; by the towns of Carlisle, Hartlepool, Maryport, Monksilver, Richmond, Windsor, &c. They have also been supplied to the City of New York, to the London, Sheffield, Shrewsbury, and several other provincial fire-offices, as well as to numbers of the nobility and gentry, including the Emperor of Russia, His Grace the Duke of Devonshire, Lady Greville, and others.

What the positive requisites for an efficient fire-escape really are, is a point upon which all parties have long since been pretty well agreed; they are, economy in the original cost, portability, simplicity of construction, and management; and, finally, facility and universality of application. All these qualifications pre-eminently characterise the invention now under review, and its facility and universality of application gives it a decided superiority over every other machine.

Mr. Merryweather's apparatus in its complete state consists of six separate ladders, each six feet and a half long, all precisely alike, each fitting into one another in whatever order they may be taken. One of the ladders, which is always the first to be raised, is furnished at the top with a pair of small iron wheels,

Fig. 2.



which considerably diminish the labour and facilitate the raising of the ladders, by running over irregularities and projections in the wall, that would otherwise seriously impede their ascent.* In the middle of the wheel-axle a small brass pulley is suspended by an universal-joint; through this pulley a rope is passed, having at one end a strong leather belt and buckle, the length of the rope being wound round two iron hooks placed on the right-hand side of the ladder.

In the accompanying drawing, a set of these ladders are represented as applied to a dwelling-house from which an escape is to be effected; four lengths have been joined up and raised, forming a ladder of sufficient height to allow persons to be lowered by means of the escape-belt from the second-floor window; while the other two lengths form a communication with the balcony.

Fig. 2 shows the uppermost ladder upon a larger, and therefore upon a more distinct scale. *aa* are the two iron wheels, with feather edges to prevent the ladder from slipping sideways; *b* is the pulley, and *c* the escape-belt; *de* are two strong iron hooks, round which the rope is coiled. The lower hook *e*, is fixed, but the upper one *d* is moveable, turning upon its centre, and having a joint nea the ladder. While the hook is turned upwards the coiled rope is held firmly in its place—but as soon as it is turned round, the joint allows the hook to fall, and the rope being disengaged is thrown down into the street. Fig. 3 shows the hook in this position. Three men are sufficient to raise a set of these ladders, in doing which, two of them place themselves inside the ladder, with their backs about three feet from the wall; each stooping, takes hold of the lowest step with one hand, and the side of the ladder with the other, and raises the ladder till their arms are perpendicular; the third party then places another ladder, narrow end uppermost, upon the ground as nearly as possible in a line with the lengths already raised; the two men then drop the ends of their ladder into the iron sockets, when the joint is made; they then stoop, again raise the ladder, and so on, till the necessary height is attained. By bevelling off the outer ends of the ladders, and making the iron sockets to correspond, Mr. Merryweather has greatly facilitated the joining, and at the same time made the ladder much stiffer than those formerly constructed. The ladder having been run up between the windows, it is shifted until it is over that from which an escape is to be effected; the fireman then runs up the ladder, turns round the hook which throws down the rope, and seizing the belt enters the window; having fastened it round the waist of a person, he puts them out of the window, while those below holding on the rope affords a safe and easy descent. The belt being unbuckled, is drawn up again, until all the inmates have been extricated. Mr. Merryweather has very judiciously adopted the belt in preference to any seat or cradle, as being more portable, more secure and much more expeditiously applied; it is of sufficient

* Although I was the first person to suggest and advocate the employment of these wheels, it is but justice to Mr. Merryweather to state, that the idea was furnished by *his escape* of 1830.—Vide vol. xiii. p. 290.

strength and capacity to lower two persons at the same time.

With reference to *portability*, I may observe that a complete set of these ladders can be carried and elevated by three men; four lengths, which will reach most second-floor windows, are within the power of two men. These ladders can be taken through the narrowest passages, or even through houses, and raised in a very small space. The average time of raising six lengths, is twenty-one seconds —I have seen them raised in *seventeen!* Four lengths have been raised to a second-floor window, and six persons brought down, by means of the belt, in one minute and a half!

A great advantage of these ladders is, that no more than the length actually required has to be raised; in nine cases out of every ten, four lengths will be found sufficient.

The *stability* and *safety* of long ladders thus formed, is proved by their being in constant use by the firemen, at fires and in ruins. Although not in the habit of mounting ladders, I have ascended and descended both by the ladder, and the belt from the roofs of high houses, with the utmost confidence.

This apparatus is of universal application, and so simple in its construction and management, that no person, however ignorant, could feel at a loss how to use it in case of need; it has been the subject of repeated commendation by the public press, and fully bears out the character they have given it, of being "*the simplest and best known external means of rendering assistance to persons in case of fire.*"

I remain, Sir, yours respectfully,

WM. BADDELEY.

London, Feb. 20, 1837.

COMPOSITION AND DECOMPOSITION OF MATTER.

Sir,—Amongst the many scientific writers in your Magazine, I do not find that any have given much of their attention to chemical subjects, although there is probably no department of physical science in which a more extensive or more interesting field is laid open for speculation and debate. I regret this, for, living as I do almost out of the reach of scientific information except what I can occasionally gather from periodicals &c., I should be glad to see these matters, in which I feel a peculiar interest, discussed in your pages. You will, doubtless, have foreseen already, that these observations are intended as a preamble to others, for which I am to beg insertion; but I hope you will not, on that account, refuse to let me occupy a small portion in your next Number, particularly as I do not often trespass on your pages.

The question concerning the constitution of matter which for upwards of 3000 years agitated the learned world, has now assumed a settled appearance; and there is rarely to be met with a person who will refuse his belief in the existence of "ultimate atoms combining in definite proportions," so beautifully has the theory, which our illustrious countryman, Dalton, has the honour, the imperishable honour, of having first proposed been developed, and so universally applicable have the laws been found, to all the tests to which they have been applied. But though the fact, that matter consists of ultimate atoms, is established, as far as *reasoning* can establish it, there still remains the difficulty of understanding the nature of that bond of union, by which two particles, or atoms of dissimilar substances, are united together, and made to lose their characters, both physical and chemical, as individuals, and to assume such a totally different character as a compound. We take a certain quantity of two invisible gases, present them under certain circumstances to each other; they disappear, and a fluid results, which on examination proves to be water; we take this water, act on it in a certain manner, in its turn it disappears, and is resolved into the same two gases as before:— the inference is a natural one: water is composed of two substances which when insulated are invisible, and bear an immense ratio in volume to the result of their combination. But can we trace in water any character similar to that possessed by oxygen or hydrogen gases? No! water then consists not of oxygen and hydrogen *gases*, but of oxygen and hydrogen, and the mystery seems to lie in the meaning of the term *gas*. Gases are generally de-

fined to be combinations of simple elements with heat and electricity, and it is supposed that while they retain these imponderable elements they are incapable of chemical combination; in the instance of oxygen and hydrogen, the two gases are supposed to be combined with opposite electricities which have no absolute disposition to quit them, but which will do so when subjected to violent mechanical disturbance, such as an electric spark (which acts mechanically), then the resident electricities are set free, and neutralizing each other, give rise to the explosion: the oxygen and hydrogen being then in their simple state, determine the formation of water; and we can easily imagine that they do not, when in this simple state, bear the slightest resemblance to the oxygen and hydrogen when under the cognizable form of gases. The electricity combined with oxygen is positive, that with hydrogen negative.

Thus then it seems, that to produce water we must first deprive its constituent parts of electricity; and similarly to decompose that fluid we must add electricity. Now, on the decomposition of water, we may safely say all the operations of nature mainly depend; it is the medium through which plants are supplied with hydrogen so essential to their existence; but how is this decomposition effected? It is easy to trace it to the action of electricity, the atmosphere is always charged with that fluid. Dr. Thomson tells us, that from the results of a journal kept during two whole years, it appeared that the atmosphere was generally charged with positive electricity, and, if I understood Mr. Crosse rightly, he stated at Bristol, in the Chemical Section of the British Association, that according to his experiments it was *always* so. According to my views it must be always positive, and its grand use is to *supply the oxygen in water with that electricity which is required to render it gaseous*, in order that the other constituent, hydrogen, should be free to perform its secret offices by uniting in its simple form with vegetables. Here then we also see how it is that the atmosphere does not become repeatedly overcharged with electric matter, for though its supply is continual, its expenditure is proportional. It is also, I conceive, through the same means that vegetables receive their supply (in part at least) of carbon. Carbonic acid from the atmosphere is decomposed on their surfaces; the positive electricity of the atmosphere unites with the oxygen, while the electro-positive element, carbon, enters the plant.

Let me now advert to other methods by which water is decomposed, and in doing so, I shall venture to propose a new idea relative to the nature of metals. When pure, *i. e.* absolutely free from oxygen, I consider them negatively electric, that is, having a redundance of negative electricity, but not all equally so in proportion to their affinity for oxygen. I conceive this surplus to exist. Iron, *e. g.* absorbs oxygen from water more readily than gold, because it has a greater supply of negative electricity to give to the hydrogen—the absence of which is necessary to the fixation of oxygen on the metal. When a piece of red-hot iron is brought into contact with water, a large quantity of hydrogen is immediately given off. Now how, I ask, could this hydrogen have been elicited from the water, without the addition of that *something* which gives it its gaseous form, and whence could this *something* have been supplied but from the iron? So if the idea that iron is furnished with an extra supply of negative electricity be scouted as absurd, let it be shown in what manner and by what means it has produced this remarkable change on the water. Again, iron wire ignited and introduced into oxygen gas, burns rapidly, loses its metallic form, and becomes an oxide, while the gas disappears; the electricities which on the one hand constituted part of the pure metal, and on the other part of the gas, have disappeared also; they have neutralized each other, and a compound of the metal and oxygen has been formed. I would willingly extend these remarks, but have filled my sheet; they shall be continued, however, if you will give them a place in your Journal.*

I am, Sir,

Your obedient servant,

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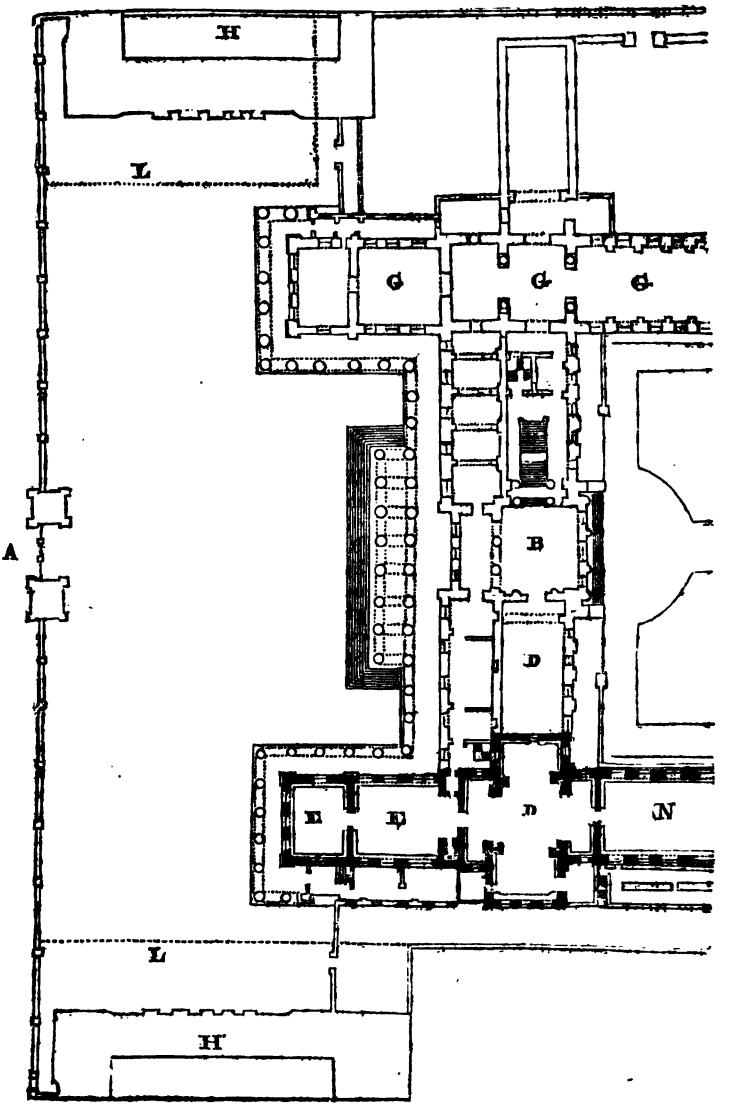
Near Bath, Feb. 18, 1837.

* We shall be happy to receive the continuation.—Ed. M. M.

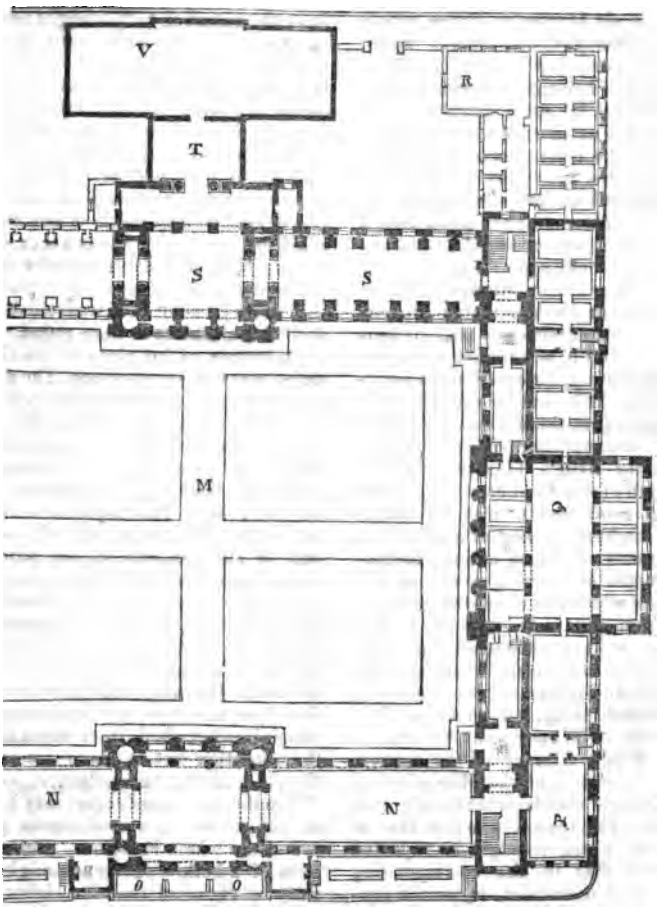
THE NEW BUILDINGS AT THE BRITISH MUSEUM.

Division 1.



Charles Lamb, in a letter of his which appeared in "Hone's Table Book," spoke with regret of the "princely apartments of poor condemned Montague House," which he predicted "would not speedily be followed by a handsomer." It cannot be denied that in one respect his prediction is now sure of being accomplished,

Division 2.



for if the buildings at the Museum were henceforth to be carried on with the most feverish haste, so much time has already been lost in their tardy and tedious progress, that the whole course of operations could never merit the epithet of *speedy*. But that the new edifice when it is completed will, with all its faults and deficiencies (and they are not few), be much handsomer than the somewhat too substantial mass of building it is destined to replace, is certainly a conclusion which all, not so exclusively attached to the odd and old-fashioned as Lamb, must have already arrived at from an inspection of the parts of the new Museum now open to the public, and which they are likely to be confirmed in from a survey of the plans for the whole recently laid by the architect, Sir Robert Smirke, be-

fore a Committee of the House of Commons.

It may be said, indeed, without any disrespect to old Montague House, whose massive chimney-pieces, inlaid floors, roomy staircases, and painted ceilings, give it an air of substantial magnificence, which some of its more modern competitors aspire at in vain; it may justly be said that the most successful parts of the new edifice are those in which it recedes the furthest from the character of the old. A nobleman's residence and a public Museum are, or ought to be, two very different buildings. The architect has in the latter an opportunity of ample and magnificent display, which the former could never consistently with its purposes afford, and if he sacrifice a particle of this opportunity, he commits an architectural sin. It is said by the officers of the Museum, that there is but one part of it which foreigners invariably admire—the splendid King's Library, with its noble length of three hundred feet. There seems no good reason why the whole Museum might not consist of a succession of apartments of almost equally magnificent dimensions, forming an unique and appropriate whole of a character perfectly distinct from any more ordinary edifice. A glance at the accompanying plan will, however, inform the examiner that the Hall of Antiquities, not yet completed, in the western wing, will be when all is finished the only apartment to rival in size the King's Library of the eastern, with the exception of the Mineralogical Gallery which stands immediately over the latter. The space above this Hall of Antiquities, which it might be expected would, like that in the corresponding wing, be kept undivided, is, on the contrary, split into a number of rooms larger, indeed, than any in old Montague House, but still not large enough to convey the impression that they belong to a great public building, and can belong to nothing else. The upper space of the remainder of the edifice is frittered away in the same manner, and the principal floor of the northern wing exhibits nothing except the Library beyond the dimensions of about sixty feet in length, by half as much in breadth.

The northern wing, however, though its size might have been turned to more account, is not of sufficient length to afford a room of the dimensions of the King's Library. From its being the furthest wing of the great quadrangle from the entrance hall, it might naturally be expected to prove the most important portion of the whole range of building; but the stranger who, from its position, forms this very natural expectation of superior size and grandeur, is doomed to be disappointed. Its length to the quadrangle is only 238 feet, while that of the eastern and western sides is 317; and this deficiency in length is not compensated by superiority in its other dimensions. Had the nature of the ground belonging to the Museum been such that this arrangement was unavoidable, the architect might have been pitied, but an examination of his plans shows that the defect was entirely of choice. The grounds of the Museum extend so far to the west of the northern wing, that the Elgin Gallery has already been erected in its rear, and still a large unoccupied space remains. Why the quadrangle should not have been built square, if built at all,—why the present *lop-sided* disposition of the premises should have been adopted, are questions likely, perhaps, to be oftener asked than answered. The only plausible reason that formerly appeared to present itself, that it was intended to preserve the Gallery of 1808, where the Townley marbles were and are deposited, and to unite it with the western wing, has vanished since the avowal of the intention not to leave one stone of the old building on another.

Another subject of regret may be found in the want of a continuous passage round the whole Museum. Built in the form of a hollow square, it might naturally be expected that the visitor would in one walk round the building survey the whole range of apartments on one floor, and so be brought again to the entrance. In the northern wing the double range of rooms will destroy this simplicity of plan, which, it is singular enough, is preserved in the cellars underneath, thus superior in one point to the magnificent rooms above.

The great fault of the plan of the building (or that which to the writer of these remarks appears to be so) is, however, still to be mentioned. Why was the great quadrangle made at all? To what purpose is that enormous space of

238 feet by 317 torn away from an edifice for which space is so much wanted. It can hardly have been done to afford a free circulation of air, for, in fact, the square, large as it is, being walled in on all four sides, bids fair to become a mere well of malaria, a "pestilent congregation of vapours." If, on the other hand, its sole purpose was to afford an occasion of architectural display (an idea which does not seem likely to have been entertained, at so great an expense of room, by any one but the architect himself), it must be acknowledged that the attempt has turned out a deplorable failure. No part of the whole Museum is so generally condemned as the fronts to the great quadrangle—they are universally censured as, like another production of Sir Robert Smirke's, the Bow-street front of Covent-garden Theatre, exhibiting a character of sternness and severity unsuited to the nature of the building; and the alterations made by order of the Trustees in the northern wing, which has been deprived of its intended portico, have spoilt the whole effect of the square, not only as Sir Robert informs us in the opinion of Earl Grey and Lord Cottenham, but in his, the architect's, own. Not a word is said of any intention to make use of the ground for botanical purposes—if, indeed, it be adapted for them—and it must altogether be considered as a dead loss.

The space thus unfortunately wasted would have provided accommodation for the whole library, much superior to what is now proposed to afford it. A reading-room, of ample dimensions, might have stood in the centre, and been surrounded on all four sides by galleries for the books, communicating with each other and lighted from the top. Two of these would have been of the length of the present King's Library; the others (supposing the present outer galleries to remain as they are) would have been 238 feet in length, and might have been of very great breadth—the whole would have formed a library unquestionably superior in splendour to any thing else of the same kind in Europe. The reading-room being in the centre of the library, the attendants would never have had to perform a longer journey to fetch any one book than about 200 feet, while under the present arrangements with the temporary reading-rooms, they have frequently to go from 300 to 400, and when the permanent ones are completed and open, they will (so excellently have they been cared for) have sometimes to travel from 500 to 600—from the north-eastern angle of the building to the manuscript rooms near the entrance. This necessity for a walk of 1000 feet or more—for there is the return journey with the book to be taken into account—will produce a necessity for no trifling expense in additional attendants (unless, indeed, some simple mechanical contrivance, such as an endless book-cradle reaching from the further end of the library to the reading-room be adopted, as it seems strange that it has not been long since, to save the endless running to and fro).

How urgently the space thus thrown away is wanted, is a fact which glares upon the reader of the Evidence before the Commons' Committee in a hundred passages. The defectiveness of the collection of stuffed quadrupeds is stated to arise from the want of room for their proper exhibition; the five-fold increase of the collection of birds within the last few years is immediately attributed to room having been recently provided to show them in. The librarian of printed books complains, that if a library of five or six thousand volumes were left to the Museum, he should be at a loss where to place it. "At the time," says Sir Robert Smirke (question 5518, p. 437), "when these buildings were first under consideration, it was stated to me by one of the principal officers of the Museum, that the average number of readers daily attending the reading-rooms was thirty. He stated, at the same time, that he thought it probable if more convenient arrangements were made for their reception, they might be increased to 80 or even, perhaps, 100. There are now frequently 200, and yet more accommodation is wanted." Additional room is, in fact, required both for the visitors and the collections, and the demand keeps increasing with the supply.

One way in which Sir Robert proposes to provide for this requisite extension of the premises, appears a most unworthy one. He takes it for granted, that no part of the exterior of the Museum, with the exception of the front, is visible from the streets surrounding it—that the view is entirely confined to the houses which

stand in those streets and back upon it. If he will take the trouble of an attentive walk up Great Russell-street and Montague-place, he will perceive that his own buildings come more into the view of the public eye than he is inclined to believe. Under the impression, however, that they do not, he proposes to append a series of rooms to the outer side of the King's Library, no matter how unsightly, for the purpose of receiving books. No more appropriate name can possibly be given to such a proposal as this, than that it is one for *cobbling* the Museum.

A preferable way of obtaining additional room would be that of transferring one part of the collections of the Museum to another national establishment—the Gallery in Trafalgar-square. When the Museum was first set on foot, it was intended to be, and it long continued, the sole receptacle for the public treasures in literature, science, (including the study of Nature) and art,—the three great departments into which it has for some time been divided, with much more show of reason than if Mr. Millard's classification had been adopted, and *sixteen* departments created, of which literature was to form but one. But a new establishment has recently been founded by Government, expressly for the reception of works of art, the National Gallery—the pictures of the British Museum have already been transferred to it—and why should not the statues follow? The collection at the Museum would then remain of an entirely homogeneous character—it would be exclusively devoted to convey literary information, while that at the Gallery would have for its object to refine and cultivate the taste. The various curiosities accumulated at the Museum might be considered as a vast assemblage of "book-plates," serving to illustrate and elucidate the literature of the library.

But if this should not be thought advisable, it would certainly be still less so to adopt the cobbling plans of Sir Robert Smirke. As it seems unavoidable that the Museum must be extended, let a *grand* design be formed for extending it, to be executed as occasion shall arise. So much has been expended on the great quadrangle, that it might seem barbarous to propose filling up the square, as ought to have been originally done. Perhaps the best plan would be to design another range of building entirely, enclosing the present on the eastern and northern sides, as the Elgin Gallery, &c. do on the west. To do this it would be necessary to purchase and pull down one side of two streets—Montague-street and Montague-place. Let it be supposed, for illustration sake, that Montague-street is begun with. The same plan could then be executed, with trifling alterations, as might have been originally effected with the quadrangle. The Library—one side of it being formed by the present King's—could be carried round four sides of a grand reading-room—a front opening fully on the street would be obtained for architectural display, and an entrance distinct from the general one might be made in it for the readers.

With the space afforded by the houses in Montague-place another scheme might be carried into effect, which has been already proposed in the *Asiatic Journal*. It has for some time been a practice with Government to borrow apartments in Somerset House for the use of the most distinguished scientific Societies. To a recent application of the Asiatic Society to be assigned the rooms vacated by the Royal Academy on its removal to Trafalgar-square, a reply has been given that the request should be taken into consideration, but, in all probability, those apartments would be required for the use of some Government offices. Would it not be better for the future to locate these grants of house accommodation at Montague rather than at Somerset House; and as a return for the accommodation afforded, might not Government stipulate that the public should be admitted to view the collections belonging to these Societies. A range of handsome rooms might be erected in Montague-place for the meetings of such Societies as should be thus favoured, devoted exclusively to their use, but communicating in the rear with a line of apartments likewise accessible from the Museum to contain the Society's collections, to which the public should in Museum days be admitted. There would thus at once be added to the national treasures already accumulated a mass of additions of no mean value. The museum of the Asiatic Society, for instance, would partly supply a deficiency which is much felt in the stores of its prouder rival, the British. Since the days of the

earlier voyages to the Pacific Ocean, which furnished it with Otaheitan dresses, South Sea islanders' idols, and other interesting articles of the same kind, there has been a singular inattention shown to the augmentation of its stock of *ethnographical* curiosities, tending to illustrate the manners and customs of nations. There has, indeed, of late been a sufficiently liberal expenditure in acquiring a number of ancient Egyptian relics; but of articles less costly, and yet quite as interesting, of curiosities throwing light on the modern life of the Mahometan and Indo-Chinese nations, there is a "plentiful lack," which must, indeed, surprise the stranger who comes with his imagination excited by the thought of the almost boundless regions which England holds dominion over in the East and West.

It may be thought that these plans are too visionary and too expensive. So would those which are actually carrying into execution have been thought twenty years ago. At that time the visitors to the Museum were, compared with their numbers now, but "few and far between." The Institution should assume an additional dignity proportioned to its increased importance in the public eye. It is true, that this view does not seem as yet to have been sufficiently impressed on the Government. Lavish in every other article of expenditure, our rulers appear to have exhibited a singular spirit of cautious cunning in every thing relating to an establishment, on which even lavish expenditure would be approved of by the vast majority of the public.*

It remains to be seen what effect the recent recommendation by the Committee of the House of Commons for a more liberal scale of grants will produce. Part of the expenditure, however, here recommended has already been decided on, since it is stated that it has long been the determination of the Trustees to apply to Government for funds to purchase some of the property of the Duke of Bedford in Great Russell-street and at the corner of Montague-street, for the purpose of the enlargement of the premises of the Museum towards the south. The amount required to effect the rest would hardly surpass that which would be indispensably requisite to execute the recommendation of the Commissioners of Woods and Forests in 1826, for pulling down the houses in front of the Museum as far back as Bloomsbury Church, for the mere purpose of adding a new square to a neighbourhood already so rich in them, and showing off the front of the Museum more to advantage. This scheme was part of a plan projected by the late Mr. Nash, which has long remained in abeyance, but which has not, it is to be hoped, been altogether abandoned since; though objectionable in many of its details, it bore in its main features an air of grandeur which stamped it worthy of a great metropolis. His proposal was to lead a new street from south to north in the direction of St. Martin's-lane, and as he had already by one broad and magnificent avenue, now famous throughout Europe and America, connected the Regent's and St. James's Parks, unite by another of equal splendour the NATIONAL GALLERY and the BRITISH MUSEUM.

P. P. C. R.

* We learn from the evidence of Sir Robert Smirke, that that delay in the building which has been so often attributed to his inaction and inattention proceeds, in reality, from the parsimony of Government, who have seldom granted more to the annual building-fund of the Museum than half what was applied for. It is due to Sir Robert likewise to state, that in various other respects—in the declination of the continuous corridor to the northern wing, and the portice which was to adorn its front—in the cutting up of the space over the Gallery of Antiquities, &c., the fault is not to be laid on his shoulders, but on that of the Trustees and officers of the Museum.

Description of Engravings of Ground Plan.

The parts shaded represent the buildings actually erected; those not shaded, the buildings proposed to be erected.

Division 1. A, the entrance from Great Russell-street.

B. Entrance-hall.

CCC. Rooms for Trustees.

DD. Department of MSS.

EE. Rooms to be also assigned to ditto, but now used as Reading-rooms.

F. Room proposed for Receiving, Sorting, &c.

GGG. Galleries for Miscellaneous Antiquities.

HH. Apartments for Resident Officers.

LL. Lines of the present Boundary Walls.

Division 2.—M. Quadrangle, 238 feet by 317.

N N N. The Royal Library.

O O O. Additional Rooms for Printed Books.

P P. Reading-rooms.

Q Q. Library of Printed Books.

R. Print-room.

S S. Gallery of Egyptian Antiquities.

T. Phigaleian Marbles.

V. Gallery of Athenian Marbles.

MR. UTTING'S ASTRONOMICAL TABLES.

Sir,—Your correspondent, Mr. J. Utting, C.E., has, in your 677th Number, made a most severe and, as I imagine, a most unwarrantable attack upon that able and assiduous astronomer, Professor Struve, of the Dorpat Observatory, in consequence of two sets of observations made by the Professor on Saturn and his ring, and on Jupiter and his satellites. Mr. Utting, in plain English asserts, that what is styled the second set of corrected observations, were manufactured from the first set, by a mere reduction of the $\frac{1}{3\,3\,\frac{1}{3}}$th part of the first set of observations. Mr. Utting adds, "it is millions of times more probable, that if fifteen dice were thrown out of a box that they should all of them come up aces, than that the above results should obtain from observations only."

Now I certainly think, Mr. Editor, that it would have been far more charitable in Mr. Utting, to have supposed, that the first set of observations might have been taken with the instruments (the telescope and micrometer), which from some cause, or combination of causes, might have been faulty, and consequently the results of the observations, although taken with the most scrupulous accuracy, would of course have been false; but that the second set of observations had been taken with more perfect instruments. I cannot, therefore, help agreeing with the remarks of the *Edinburgh Journal of Science*, "that their accuracy may be inferred from the slight difference between the old and new results." Besides, what earthly motive could the Professor have had for committing such a contemptible fraud? He has always borne the character of being one of the ablest, assiduous, and most faithful astronomical observers of the present age. If such a sweeping charge were to be brought against our Sir John Herschel, or Sir James South, who would believe it?

But, Mr. Editor, who could have imagined that Mr. Utting, after having brought such a serious charge against the Professor, should in his next communication to the *Mechanics' Magazine*, (No. 705) have been guilty of a similar kind of simulation as that which he imputes to the Professor? In the said communication he states, "On examining (not astronomically observing, be it known) the motions of the planets and their satellites for different periods of time, I find that a conjunction of all the planetary bodies takes place (or does not take place, he should have added) after a period of 250,904 solar years, in which are contained 91,640,740 mean solar days, supposing them to have been in conjunction at the commencement of the above period."

Mr. Utting in his first table gives us the number of revolutions the planets describe round the centre of gravity of the solar system, and also the periodical times in mean solar days, &c.; and this he has given to the hair-splitting accuracy of the ten thousandth part of a single second of time!! That is, if all the planets were exactly in conjunction, at the end of 250,904 solar years, they would all be again in conjunction, having each finished a complete number of revolutions, and consequently all arrived at the same points in their orbits that they were in at the commencement of the above period. If the first seven mentioned planets would be kind enough to adjust their periodical times to that calculated by Mr. Utting, the conjunctions would no doubt happen in the way and time he has mentioned. But I will ask Mr. Utting from what authority has he deduced the periodical times of the planets given in his first table? For I find that none of them agree with the best modern discoveries. The periodical time of the earth is very nearly true, but of the others some are minutes wrong, some hours, some days, yea, even months wrong. The truth is,

Mr. Utting, by the aid of his knowledge in arithmetic, has himself manufactured all the times of these tropical revolutions, so that there may be a complete number of revolutions performed in 250,904 solar years. With regard to the moon, he must manufacture a new period for her ladyship; for although the period of 27 days 7 hours 43 minutes 4·7129 seconds is contained very nearly in 91,640,740 mean solar days, still this will not answer in the case of a conjunction; he must try and make it as near as he can to a synodical month, and yet an exact part of 91,640,740. Instead of the time from conjunction to conjunction of all the planets being performed in the way and time he mentions, let him take the time of their tropical revolutions from the best authority, only to the nearest second of time; and instead of the time being only 250,904 solar years, it will be many millions of times that period. Then suppose we only take two of the planets, namely, the Earth and Saturn; and let us assume the tropical periods to be 365 days 5 hours 48 minutes 49 seconds, and 10746 days 19 hours 16 minutes 15 seconds, it will be found that one of Mr. Utting's conjunctions between these two planets only and the sun, would require a period of no less than 928523775 solar years; and, combining this period with the tropical time of revolution of a third planet, we would obtain a number of solar years, prodigiously greater than the above-mentioned period, and so on for the other planets. Indeed, we might go a little farther and say, that suppose two planets to be in conjunction with the sun, there never will in time, be another exact conjunction of the said two planets and the sun, each planet having performed a complete number of revolutions; and this would be the case if the respective times of their tropical revolutions were incommensurable, and this is as likely to be the case as not.

I might still go on, Mr. Editor, to make several other remarks upon Mr. Utting's last article, but I am afraid this letter has already extended to too great a length.

I am, Sir,

Your obedient servant,

A SCOTCH DOMINIE.

Forfarshire, Feb. 17, 1837.

ABSTRACT OF THE NEW PATENT LAW BILL.*

A Bill to Amend the Practice relating to Letters Patent for Inventions, and for the better Encouragement of the Arts and Manufactures.

§ 1. His Majesty, by charter or Letters Patent under the Great Seal, may establish a board of commissioners to carry this Act into execution; and by commission under the Great Seal appoint *one* person to be the chief of such commissioners, and *two* other persons to be other commissioners of the board. The commissioners are to hold their offices during their good behaviour, and so long as they shall personally give their attendance upon their respective duties, and shall conduct themselves honestly and faithfully in the due execution of the duties of their offices.

§ 2. The commissioners are to be styled "*The Commissioners of Patents for Inventions,*" and any *two* of them may sit as a board of commissioners; and acting as such, they are empowered, by summons under their hands and seal, to require the attendance of all such persons as they may think fit to call before them upon any question or matter connected with or relating to the administration of the laws relating to Letters Patent for inventions over which they shall have any jurisdiction or control by virtue of this Act; and to examine all such persons upon oath, and to require and enforce the production upon oath of all deeds, models, drawings, books, contracts, agreements, accounts and writings, or copies thereof respectively, in anywise relating to any such question or matter; or in lieu of requiring such oath, the commissioners may, if they think fit, require any such person to make and subscribe a declaration of the truth of the matters respecting which he shall have been or shall be so examined.

§ 3. Commissioners are to have a common seal, and the rules and regulations sealed to be received as evidence.

§ 4. His Majesty to appoint one principal secretary and two registrars of board.

§ 5. The commissioners to have power to appoint inferior officers, and their salaries to be regulated by commissioners of Treasury.

§ 6. Commissioners to take an oath prescribed in the Act, "faithfully, impartially, and honestly," to execute the trusts reposed in them, "without favour or affection, prejudice or malice."

§ 7. The commissioners to hear and determine all matters relating to Letters Patent for inventions hitherto heard by the attorney

* The second reading of this Bill, which was fixed for the 2nd of March, has been deferred to the 1st of April. We shall offer a few observations in our next Number.

and solicitor-general; but the powers of commissioners not to interfere with the jurisdiction of the Judicial Committee of Privy Council or Courts at Westminster.

§ 8. The powers of the attorney and solicitor-general to cease, and to be transferred to the commissioners.

§ 9. From henceforth the practice now in use in obtaining Letters Patent for inventions shall cease, and in lieu thereof, every person who shall be desirous of presenting a petition to his Majesty for the grant of any Letters Patent for any invention, shall leave or cause the same to be left at the office of the registrar of the said commissioners, accompanied by such *affidavit* in support thereof as hath been heretofore in that behalf accustomed, or as the said commissioners shall by any general order or orders to be at any time issued by them in that behalf direct, and that the said registrar shall thereupon cause such petition and affidavit to be filed and kept as of record for the purposes of this Act.

The commissioners to publish objects of petition in the London Gazette, and appoint a day for hearing all objections to grant of Letters Patent.

The parties to attend the commissioners by themselves or their agents to support and oppose grant of Letters Patent, and commissioners if they shall think the prayer of the petition ought to be granted, to make out a draft or bill of Letters Patent, and send same within one calendar month to Secretary of State for his Majesty's sign manual. The Secretary of State to return draft or bill, with his Majesty's sign manual, to the commissioners, and the commissioners to make out Letters Patent, and send same with draft or bill to Lord Chancellor. Lord Chancellor to affix Great Seal to Letters Patent, and return same to commissioners.

§ 10. Repeal of so much of Act 5 & 6 Will. IV., as relates to entering disclaimer and memorandum of alteration.

§ 11. Any person who, as grantee, assignee, or otherwise, hath obtained, or who shall hereafter obtain, Letters Patent for any invention, shall be desirous of disclaiming, amending, or altering any matter or thing in the title of his said invention, or the specification relating thereto, may, if he think fit, make or cause application to be made, to the said commissioners for leave to enter with the registrar of the said commissioners a memorandum of such disclaimer, amendment or alteration, stating the reasons therefore respectively, the same not being such disclaimer, amendment or alteration as shall extend the exclusive right granted by the said Letters Patent.

§ 12. Commissioners to publish application for leave to disclaim, and fix a time for hearing parties in support and opposition to such entry. The memorandum filed with registrar to be deemed part of Letters Patent or specification. Provided in all suits then pending, original Letters Patent, &c. alone be given in evidence.

§ 13. *Stamps* on Letters Patent reduced to 10*l.* viz. 5*l.* on the petition, and 5*l.* on the specification.

§ 14. In Letters Patent which shall hereafter be obtained for any invention, there shall be inserted a memorandum or indorsement, the same to be verified and attested by the seal of the said commissioners, setting forth the day of the date on which the petition to his Majesty, for the grant of the said Letters Patent, was filed at the office of the registrar of the said commissioners, and that the said last-mentioned day shall thereupon be held and taken to be the day of the date of the said Letters Patent, in all actions, suits, and other proceedings relating to the said Letters Patent, and to all intents and purposes whatsoever: Provided always, that the specification shall be enrolled in the manner and within the period in that behalf fixed by the said Letters Patent: And provided also, that the time for which the sole making, exercising, using, and vending of any invention shall be hereafter secured by any Letters Patent, shall bear date from the day of the sealing of such Letters Patent respectively.

§ 15. Letters Patent to extend to Great Britain, Ireland, and the Colonies, except when specially limited.

§ 16. And whereas it is expedient, for the greater encouragement of the useful arts and manufactures in these realms, to afford some further protection and assistance to the inventors of new and useful improvements, by vesting the property therein in the inventors or proprietors thereof for a period shorter than that for which Letters Patent for inventions are usually granted; be it therefore enacted, that any person who shall hereafter invent, design, or contrive, or shall become the proprietor of any invention, design, or contrivance, whereby, in the opinion of such inventor, designer, contriver, or proprietor, some new and beneficial operation or result shall be obtained in any art, science, manufacture, or calling whatsoever, shall hereafter have the sole right and property in every such new invention, design, or contrivance, for and during the term of *twelve* calendar months from the time of registering the same in manner and under the regulations herein in that behalf mentioned.

§ 17. Persons availing themselves of this Act, to deposit a fac-simile, model, or specimen of their invention with commissioners.

§ 18. Commissioners to find some suitable

place for exposing models, &c. to public inspection.

§ 19. Persons depositing models, &c. to pay the sums mentioned in schedule to Act, and to be entitled to a certificate sealed by commissioners.

§ 20. Persons imitating subject-matter of license, without consent of person having license, or marking "Licensed" on same, to be liable to a penalty of 50*l.* for every offence. Certificate not to exempt persons from liability for infringements of patents. Subject-matter of license not to be afterwards subject of Letters Patent; not to be capable of a second license.

§ 21. Present fees respecting Letters Patent to cease. No fees payable for any thing to be done under this Act, save as set forth in schedule or general order of commissioners.

§ 22. The secretary of commissioners to receive fees in schedule set forth, and also all other sums payable under this Act, and to pay same into Bank of England once a week to credit of commissioners. Monies in Bank subject to orders of commissioners, or as directed by this Act.

§ 23. The salaries to be paid to the officers are not yet inserted in the Bill.

§ 24. If any commissioner, secretary, assistant secretary, registrar, deputy registrar, clerk, messenger, or any other officer or person whatsoever, shall for any thing done or pretended to be done under this Act, or under colour of doing any thing under this Act, fraudulently and wilfully demand, or take, or appoint, or allow any person whatsoever to take for him, or on his account, or for or on account of any person by him named, or in trust for him, or for any other person by him named, any fee, emolument, gratuity, sum of money, or any thing of value whatsoever, other than is allowed by this Act, or any rule, order, or regulation made or to be made in pursuance of the provisions thereof, or shall directly or indirectly be engaged or employed, and either as principal or agent in the procuring, maintaining, or opposing the grant of any Letters Patent or license for any invention, or in any matter or thing connected therewith, save in the performance of the duties of his office as such commissioner, secretary or assistant secretary, registrar, deputy registrar, clerk, messenger, or other officer, such person, when duly convicted thereof, shall forfeit and pay the sum of five hundred pounds, and be rendered incapable and is hereby rendered incapable of holding any office or place whatsoever under his Majesty, his heirs or successors.

§ 25. Commissioners shall from time to time, as it shall appear to them expedient, make and issue such general orders as they shall think fit for carrying the provisions of this Act into execution, *and also for regulating and affixing the fees to be hereafter paid and payable at the offices of the Lord High Chancellor and of his Majesty's Principal Secretary of State respectively, as well as the other fees to be paid and payable at the office of the said commissioners appointed under and by virtue of this Act, and which are not set forth in the schedule hereto annexed in respect of the several matters and things to be performed at the said offices respectively*, and shall also from time to time make and establish such other rules and regulations not being inconsistent with the enactments and provisions of this Act, or of any general order to be made and issued as aforesaid, as they shall in their discretion think fit and proper for simplifying, establishing, and settling the practice to be henceforth in use relating to Letters Patent, and licenses for inventions, and from time to time to alter and rescind the same, or any of them: no general order of the said commissioners shall operate or take effect until the same shall have received the sanction and assent of the Lord High Chancellor.

§ 26. Compensation to be awarded to persons injured by the operation of this Act. Commissioners of Treasury to take into account whether any office under this Act is held by person claiming compensation. Commissioners of Treasury to award compensation. Commissioners of Treasury to signify amount of compensations to commissioners of patents, who shall thereupon order same to be paid out of monies standing to account of said commissioners. Rates of compensation to be laid before Parliament.

§ 27. Monies standing to account of commissioners, chargeable, first, with compensation, secondly, with salaries of officers, and expenses, and surplus to be carried over to Consolidated Fund.

§ 28. Act may be altered this Session.

§ 29. Act to come into operation as to appointment of officers on passing, as to other matters, first of January one thousand eight hundred and thirty-eight.

Schedule of Fees.

On filing every petition to his Majesty for the grant of Letters Patent for any invention extending to Great Britain, Ireland, and his Majesty's Colonies abroad	£100
Ditto, extending to England alone . .	40
Ditto ditto to Scotland alone .	25
Ditto ditto to Ireland alone . .	40
Ditto, to England and Scotland alone	65
Ditto, to England and Ireland alone .	80
Ditto, to Scotland and Ireland alone .	65
Ditto, to the Colonies alone . . .	25

On the delivery of Letters Patent for any invention extending to Great Britain, Ireland, and his Majesty's Colonies abroad	£100
Ditto, extending to England alone	40
Ditto, to Scotland alone	25
Ditto, to Ireland alone	40
Ditto, to England and Scotland alone	65
Ditto, to England and Ireland alone	80
Ditto, to Scotland and Ireland alone	65
Ditto, to the Colonies alone	25
For the deposit of every fac-simile, model or specimen	10
For every certificate of license	1

NOTES AND NOTICES.

The Spanish Picture Gallery. — Among the schemes of the Spanish Minister of Finance for raising money (a very scarce article just now in the Royal Treasury), there is said to be one for raising a loan from our Government on the security of the pictures in the Royal Gallery at Madrid, which are to be sent to London, and the money received for their exhibition to be applied to paying the interest of the loan. If this be true, the British metropolis will soon possess one of the very finest collections of pictures in the world. The Spanish gallery has only been formed of late years, and is composed of the paintings from all the royal palaces; it comprises 42 pictures by Murillo, 55 by Velasquez, 29 by Spagnolette, and many others by the most distinguished Spanish artists, besides between four and five hundred of the Italian school, and about three hundred of the Flemish. According to one of the witnesses before the late Parliamentary Committee on Arts and Manufactures, it may be considered to take the second place among the galleries of Europe, the first being conceded to the celebrated Grand Ducal Gallery of Florence, and the Dresden Gallery being compelled, since the formation of this, to yield precedence to it. It may very naturally be expected, when the financial condition of Spain is considered, that if the collection should once reach this country, it will never find its way back again; in that case, we shall have a "National Gallery" worthy of the name, by the junction of our own (a pigmy in comparison) with the Spanish; and a building far exceeding in dimensions (and, it may be hoped, in elegance and splendour,) Mr. Wilkins's pet production in Trafalgar-square, will be required to contain it. The idea of paying ourselves the interest on our loan by the shillings taken at the doors, seems ridiculous: of course the money would be advanced out of the national funds, and the collection thrown open, free of expense, to the public at large. But "let us not reckon our chickens before they are hatched."

The Institute of British Architects have at length obtained a Charter of Incorporation, which they have long been anxiously expecting. It is difficult to imagine what peculiar powers for the improvement of their profession the royal sanction will give them, but of late it has become the fashion for every *respectable* association to procure the distinction by way of blazoning their consequence to the world, and therefore the British Architects could hardly be expected to remain in the background.

Reciprocity in opposition to Free Trade.—A petition has lately been presented to the American congress from a number of the most popular English authors, requesting that English copyrights may be secured in America, on condition of American copyrights being secured in England. It will be hard, we calculate, to catch Brother Jonathan agreeing to such a reciprocity system as this, while the advantage is, as at present, so decidedly on his side. Negotiations are also going on to prevent the reprinting of English books in France, which the French seem willing to do, if we can be prevented from importing the Brussels piracies of new French works, which are got out there almost as soon as the originals appear at Paris.

The late Sir John Soane.—The executors and trustees under the will of this gentleman have refused to make themselves participators in the testator's feelings, by taking upon themselves the trusts conferred on them by that document, which consequently remains unproved. Mr. Soane, heir-at-law, has, by the advice of several advocates of the Ecclesiastical Court, entered a *caveat* against the admission of a testamentary paper, on the plea of insanity. He has left a great number of small annuities, and after the death of all the legatees he has made a Mr. Foxall residuary legatee. This individual, who is a respectable tradesman, is in no degree related to or connected with Sir John. The majority of the legatees have expressed their desire to see the family property, which amounts to nearly 200,000*l.*, restored to Sir John's own family.

Cotton.—The quantity of American cotton exported annually is 291,310,115 lbs., the value of which is 29,359,545 Spanish dollars, 6,330,651*l.*; whereas, the total export from all India was only 68,411,015 lbs., the value of which, at 25s. per maund of 80 lbs., would be 1,068,922*l.*; so that the importation of the American cotton in Britain has increased from about 10,000 lbs. to 294,000,000 lbs., and the increase of the Indian cotton is but 68,000,000 lbs.—*East India Magazine.*

Spots on the Sun.—On Saturday week a spot of unusual magnitude was observed on the sun's disc. It was so large as to be distinctly visible to the naked eye in the upper hemisphere of the luminary, and near the eastern limb. This macula or spot is conjectured to be ten times the volume of the earth. —*Globe of March 6th.*

Spontaneous Combustion.—It is stated by Mr. Murray, the chemical lecturer, that if linseed oil comes in contact with cotton, it will occasion spontaneous combustion.

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

A complete list of Patents from the earliest period (15 Car. II. 1675,) to the present time may be examined. Fee 2s. 6d.; Clients, gratis.

Patent Agency Office,
Peterborough-court, Fleet-street.

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BADDELEY'S STATIONARY FIRE-ENGINE.

Fig. 2.

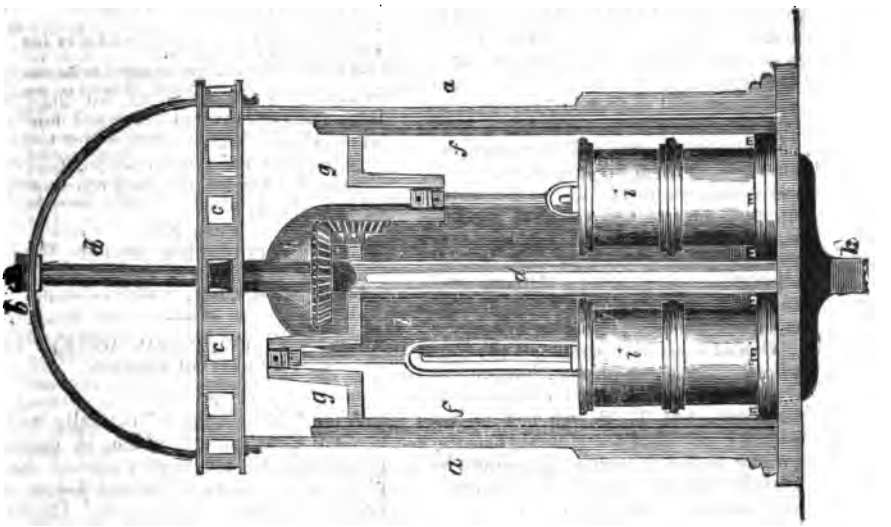
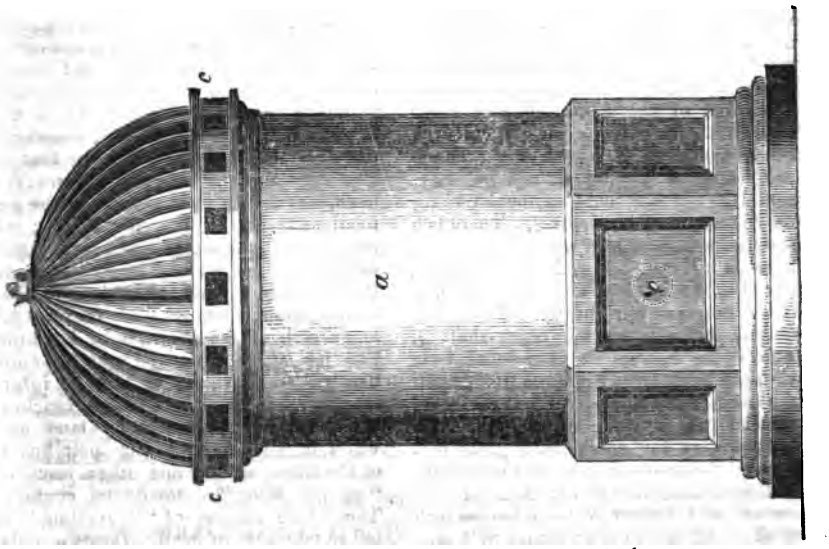


Fig. 1.



BADDELEY'S STATIONARY FIRE-ENGINE.

Sir,—At page 50 of your present volume, I stated, that out of every ten American Patents, nine were either for some useless contrivance, or for some slight modification of previous English inventions. At that time I brought forward an instance of the latter kind; I now beg to refer to one of the useless description.

At page 153 of your last volume, there is a description of a patent taken out by Mr. Thomas Odiorn, of Portsmouth, New Hampshire, for a fire-engine, with a circular platform on the top of the cistern, upon which the persons who work the engine are to walk. The whole disposition of the thing is bad, but the idea of carrying about a platform ample enough for this purpose, as part and parcel of a fire-engine, is preposterous.

One of your correspondents (T. P.) at page 9 of the same volume, has proposed a plan in some respects similar to the foregoing, but T. P. appears to have wholly overlooked the *stability* necessary for the purpose, which Mr. Odiorn had provided for, although at the sacrifice of all reasonable portability.

The real fact is, that the only way in which the principle proposed by these two gentlemen, can be employed with any prospect of advantage, is in stationary engines; and the prefixed sketch, fig. 1, is a stationary fire-engine which I designed a long time ago, calculated for the yards of public buildings or large manufactories. It consists of a cast-iron cylindrical casing *a*, with a fluted dome-shaped cap *b*, having sixteen holes *c c*, round its circumference at the base, for the insertion of handspikes. There is a screwed nozzle at *e*, to which the leather hose is affixed. Fig. 2, is a section, showing the internal arrangement. *d d*, is a strong iron upright, which, with two others, *f f*, support the crank-shaft *g*. The dome *b*, and its cylindrical base with the lever holes *c c*, turns freely upon the upright *d*, carrying with it the bevel wheel *h*, which taking into another similar wheel on the crank-shaft, gives motion by means of slings to the two pistons in the working barrels *i i*; these are six inches in diameter with a twelve-inch stroke. Water is drawn from a well, &c., by the suction or feed-pipe *k*; *l*, is the air-vessel, from whence the water passes out at the screwed nozzle *e*.

Wherever water can be obtained in sufficient abundance, either from a well, tank, &c., an engine of this description is calculated to render most efficient service in case of fire. There are sixteen places for the insertion of handspikes, to each of which at least two men—perhaps three—might apply their strength, under favourable circumstances.

The best way of keeping leather hose in readiness for stationary fire-engines, is to have it coiled upon a reel, and mounted on a small hand-barrow, which might also carry the levers, branch-pipe, hatchet, crow-bar, a few buckets, and other apparatus useful at fires.

I am, Sir,
Your obedient servant
WM. BADDELEY.

London, March 8, 1827.

M'CULLOCH'S STATISTICAL ACCOUNT OF THE BRITISH EMPIRE.

(Second Notice.)

After "Manufactures" naturally succeeds "Commerce," which of course gives room for plenty of statistical display, in the shape of official Tables of Exports and Imports, Customs' Duties, and so forth; and this leads to a section on the "Means and instruments by which Commerce is facilitated and carried on," which brings to mind another remarkable omission. The present age has been styled the age of Literature and Locomotion; we have already seen that our author thinks fit to leave out the statistics of the former, and it will, therefore, probably excite the less surprise that he also does the same by the latter. We have, it is true, a short account of the general state of the Turnpike Roads; we have, also, somewhere about *three pages* devoted to the history of Railroads in Great Britain (!) and a few more to that of its Canals. But we look in vain for any sketch of those means of Locomotion for which our island is so pre-eminently distinguished; we find no information as to mail and stage coaches, vans, waggons, steamers by land and water, hackney-coaches, cabs, omnibuses, or the thousand and one other ways of "getting along" in town and country. The whole subject of "Travelling" is left to take care of itself. Roads, canals, and railways, are only mentioned in so far as they are connected with the facilities they afford to commerce on the large

scale—the commerce of the extensive merchant; for Mr. M'Culloch appears to think that retail commerce,—that which concerns itself with the more immediate supply of the wants of the population,—hardly comes within the scope of his work. In this he is, of course, most woefully mistaken: of the two, the latter should have received the most attention, in a work professing to afford a general survey of the condition of the kingdom and its inhabitants.

The remaining, and by far the larger portion of the second volume, is taken up with a very lengthy and widely-printed series of articles on the Constitution and Government, Courts of Law, Corporations and Religious Establishments of the three Kingdoms. This division might well have borne compression,—nor do we see the necessity of printing it in a larger character than the rest of the work, and so making it occupy much more room than was absolutely necessary. It would have answered every proper purpose of the work to have dismissed most of these subjects with much less particularity of detail than has been bestowed upon them, particularly those parts relating to the forms and practices of the courts of law, for the verbosity of which we are indebted to the care taken by the Editor to obtain the assistance of "professional gentlemen" for those departments. A division of "Miscellaneous Particulars" concludes the work, the separate chapters relating severally to "Establishments for Public Education," "Revenue and Expenditure," "Army and Navy," "Vital Statistics," and "Provision for the Poor;" and a fragment has also been broken off from this department, and added to the first volume,—apropos of nothing, for the sake of making the volumes of uniform thickness—the most important article of which, is an "Essay on the Origin and Progress of the English Language," of a very disappointing character. Under such a head, the reader naturally looks, above all things, for some account of the statistics of the language; for details as to the countries in which it is spoken, and the numbers speaking it—of the extent to which it is known in foreign lands, and to which it is unknown among the nations under British sway:—in place of all this, we are presented with a very common-place sketch (all its facts being old familiar faces) of the state of the language itself from "the earliest periods" to the time of Queen Elizabeth, or thereabouts; with a philological essay, in fact, having nothing statistical in its composition.

In another important respect, Mr. M'Culloch is also found wanting. From the comprehensive nature of his title, in which "the British Empire" shines so conspicuously, it might well be inferred that our immense colonial possessions were to receive more than the usual quantum of attention: so far from this being the case, however, our author confines himself so strictly to the department of "Home Affairs," that he dismisses the whole of the Colonies, India and all, in something less than a dozen pages.

Yet, with all this exclusiveness, it is remarkable that what may be termed our "domestic statistics" are strangely neglected. We have already noticed some unaccountable omissions of this kind, to which we have to add, that, while Corporations and Courts of Law are treated of, at even a tedious length, public institutions of more direct and practical usefulness are completely neglected, or, if mentioned at all, only in a cursory and incidental manner. The modes of obtaining a supply of water in London and the other principal towns of the kingdom, might surely have filled a few pages quite as appropriately as a notice of the Insolvent Debtors' Court; and Gas-lighting would have headed a section as well as the Kirk Session of Scotland. Even a little information, also, as to the Amusements of the People (of which there is not one word) might have proved acceptable, even had a few pages of the closely-printed Returns on Crimes and Punishments been left out to make room for them. Literature being excluded, of course no details as to Literary and Scientific Institutions are to be looked for.

The book is exceedingly well printed and "got up," but what decoration is bestowed upon it is entirely typographical; it contains not a single wood-cut or other embellishment, not even a map of the British Islands. It is altogether, *par excellence*, "the book of deficiencies," and very ill qualified, in almost every respect, to fill up that hiatus in our literature which it professes to supply.

ALDERMAN WOOD'S METROPOLITAN IMPROVEMENTS.

Report from the Select Committee of Metropolis Improvements, with the Minutes of Evidence and Appendix. Ordered by the House of Commons to be printed.

The nation owes an eternal debt of gratitude to George IV. for the planning and effecting of Regent-street. The profusion which was natural to him was on that occasion more productive of solid good, than perhaps the wisest and most rigid economy would have been. Amid the dingy, dismal, unaspiring streets of London, the lavish splendour of what is indeed a Royal road, "rose like an exhalation," and, by the force of contrast, attracted an attention which the chastest efforts of corrected taste might long have courted in vain. The public attention once aroused, the effect was soon evident. The march of public affairs has not been so changed by the carrying of the Reform Bill, as the aspect of our street architecture by the creation of Regent-street. Since then we may have had to complain, and but too truly, of bad taste, and very bad taste, indeed; but still in most cases even the bad taste has been gorgeous; in every thing that has been done there has been at least an attempt at splendour; and whatever London may become, it is at least sure not to remain that mere inanimate "mass of bricks and mortar," that dowdy "agglomeration of country towns" as which it might once with but too much show of reason be taunted.

The recent improvements effected in the City—which bear so plainly upon them the stamp of the influence of their prototype—have, it appears, awakened an appetite for more. This might have been expected, for in some respects they surpass even those of the west end. The makers of Regent-street had to force their way through a dull, monotonous mass of streets, which did not afford them a single great object of architecture to adorn their new thoroughfare; they found absolutely nothing, but created all. In the City it is just the reverse; the finest parts of the new improvements are those which the improvers have merely brought to light from the dark recesses in which they formerly lay concealed. By widening Princes-street, by forming Moorgate-street, they have thrown the Bank more into view; by the demolition of the unlucky "Lucky Corner," they have shown to more advantage the Mansion House, and, as it were, unburied the church of St. Mary Woolnoth*—while, to terminate the view, as if built expressly for that purpose, rises above the houses the lofty column of the Monument. The same kind of result is sure to attend almost every similar operation of widening and beautifying in these thickly-crowded regions. In the narrow streets of the City there are many fine buildings so elbowed in, that every atom of their effect is lost, that the architect himself could hardly form an idea of their beauties—but which, if extricated from the shapeless confusion that surrounds them, would at once take their place as worthy of ornamenting any street, however splendid, that can be formed for their display. To quote no minor instance, let the citizen of London only think of St. Paul's. The mere creation of a square, no matter how built or how ornamented, one side of which should be formed by one side of that magnificent structure; or of a street leading up to either its northern or southern door, would supply a point of beauty which the expenditure of twenty times the sum in any other part of the metropolis could not rival. There are spots in its neighbourhood which might justify us in quoting, with a slight alteration, in reference to the architectural enthusiast, the words of Wordsworth with regard to the lover—

> "All Paradise
> Could by the mere *upsetting* of a *house*
> Let itself in upon him."

Such are the advantages which the City offers to its improvers with respect to beauty. There is, however, a stronger motive than the desire of producing this to operate in impelling the powers that be to make extensive alterations in this part of the metropolis. It is at length distinctly recognised, that the enormous traffic carried on through the main arteries of London imperatively demands additional thoroughfares for its accommoda-

* It is to be hoped there is no truth in the report, that it is intended to reconstruct the Globe Fire-office nearly on its present site, with merely the edge shaved off. Just at that part of the City there can hardly be too much space allowed both for the convenience of commerce and for the appearance of the buildings. The City improvers should not, to save a few pounds at the end of their undertaking, destroy half the effect of what it has cost hundreds of thousands to execute.

tion; that with a population of a million and a half crowded together in one vast capital, the streets and roadways which might suffice when its population was only half a million can no longer be deemed sufficient. The two motives—the desire of having a city both better "pierced" and better looking than we are yet able to boast of—probably co-operated in inducing the City Member, Mr. Alderman Wood, to apply to the House of Commons for the Committee on "Metropolitan Improvements," the Report of which it is now our intention to examine.

We regret to say, that the Committee does not appear to have taken so wide a survey of the subject as was generally expected, from the comprehensiveness of its title. It was thought that it would make a point of taking into consideration all the suggestions for the improvement of the metropolis that have of late years been prominently brought before the public, with the view of deciding on their eligibility or practicability. We find, however, not a word on the subject of Colonel Trench's Thames Quay, of Mr. Martin's plan for the improvement of the banks of the river, or any other project of the kind. The suggestion of Sir Robert Peel, that the Committee should not only occupy itself with the improvements called for at the moment, but also with those likely to be required in course of time by the increasing extension of the metropolis, has likewise been treated with disregard, though evidently founded on the plainest dictates of common sense. No means appear to have been taken to secure to the Committee an acquaintance with the number of plans which have of late years been formed, but not yet published, by ingenious men bearing on the object in view; and it does not even seem to have informed itself of the plans in contemplation by the Commissioners of Woods and Forests, who are said to meditate extensive alterations in some of the very districts this Committee talks of improving also. The only "metropolitan improvements," in fact, brought under their notice, with a very few exceptions, are a lot of Alderman Wood's own! The evidence altogether occupies only fifty-four pages, and of these scarcely more than ten contain information bearing even on the subject of the Alderman's improvements; the remainder are occupied with discussions on the preferability of raising the 1,500,000*l.* required by means of a lottery (to which Mr. Bish, who is summoned as a witness, doth most "seriously incline") or by a tax of 6*d.* per ton on coals, which it is stated that, somehow or other, the poor will not feel at all!

What these improvements are we shall now afford the reader an opportunity of judging, by extracting a list of them from the Committee's Report, to which we shall take the liberty of adding a few remarks of our own.

"*City of London.*—A new street from the Bank to the General Post-office."

This is to run from the Lothbury end of Moorgate-street to the corner of the Post-office, near Goldsmiths' Hall. Were this street in existence already, it might be preferable certainly to the route now adopted, from one of these points to the other, but we see no advantage to be gained by its formation adequate to the expense of forming it. There is already one street (Cheapside and the Poultry) running direct from the Bank to the Post-office.

"A new street from the General Post-office to Newgate-street."

This proposal appears at first rather enigmatical, inasmuch as there is already St. Martin's-le-Grand in existence to supply the desideratum. By referring to the lithographic plan, however, we discover that the street proposed is one to run direct from the portico of the Post-office to about the middle of Newgate-street, coming out near the new buildings of Christ's Hospital. It is difficult to see what can be the meaning of such a proposal as this. What could the Alderman be thinking of? The expense of this scheme would be enormous, its utility—0.

"The improvement of Skinner-street and Holborn-hill."

This is to be effected by carrying a bridge over the valley of Holborn at the height of twenty-one feet above Farringdon-street, while the roadway is to be widened, and part of it left at its present level. The same improvement, with some difference in the levels, was proposed to be executed by a joint-stock company about a year ago. In fact, the scheme was often proposed before, and is any thing but new—it has, however,

a greater recommendation, in obvious utility.

"A new street from the Mansion House to the Southwark-bridge."

This is to commence in front of the church of St. Stephen, Walbrook; why not at the grand meeting of the roads now in progress of formation in front of the Mansion House, we are at a loss to perceive; that is, if the plan be adopted at all. The scheme appears to be a favourite, but its advantages are not very obvious. By conveying the traffic of another bridge to the line of Princes-street and the City-road, it seems likely rather to augment than to diminish the complaint of over-crowded thoroughfares. Were a new way carried instead, as has been proposed, from Southwark-bridge to the Watling-street corner of St. Paul's Churchyard, a communication would be effected with the Aldersgate-street and Goswell-street line of road, which would tend to vivify a part of the town at present not over alive.

"A new street from St. Paul's Cathedral to Blackfriars-bridge."

With regard to exhibiting the Cathedral, this improvement would be little better than a duplicate of Ludgate-hill, as it approaches the front of the building at nearly the same angle. For the purpose of display, a street coming up to either side or to the back of the Cathedral, would evidently be superior to either, as the great feature of that majestic edifice, the dome, is too far removed from the front to be seen in all its grandeur except at some distance. A street, or rather a square, from the southern door to the water-side would, perhaps, be the most eligible way of effecting an object which every admirer of architecture in the metropolis must be eager to see effected—the proper exhibition of a masterpiece which London is not likely ever to equal. This square would afford an excellent site for a new building for Doctors' Commons, &c., a little more worthy of the business transacted there.

"*County of Middlesex.*—A new street from Farringdon-street to the Sessions' House, Clerkenwell."

This is the well-known scheme which has now been in agitation some years. The new street here terminates in a very abrupt and *undignified* manner at the back of Hicks's Hall.

"A new street from Westminster Abbey to Pimlico."

There is hardly a crookeder street now in London than the one which it is here proposed to cut from the front of Westminster Abbey to—where?—to Eaton-street, Pimlico. The necessity for it we do not exactly see, but we should suggest that a new way be cut immediately from the projector's house to St. Luke's Hospital. Among the other agreeable features of this Westminster Abbey scheme, is the destruction of the old Jerusalem chamber mentioned in history and Shakspeare, as the room in which Henry IV. expired, and so singularly connected with the prediction of his death.

"A new street from Oxford-street to Plumtree-street, St. Giles's."

For the last fifty years, at least, there have been very few individuals who have ever taken up a map of London, with the idea of suggesting improvements, who have not at once hit upon the idea of carrying Oxford-street straight on into Holborn. Of all alterations that have been or can be suggested, this is the most obvious; in fact, the only objection to its execution is, that it would deprive society of the most *classical* remark it possesses on the subject of metropolitan improvements—one which is invariably made, and almost unanimously assented to, whenever the topic arises in conversation. We say *almost*, because it appears from this Report that there are one or two individuals in London who propose, instead of carrying Oxford-street straight on, so as to enter Holborn about Southampton-street, to make it diverge (in a manner, perhaps, just one grain better than its present abrupt turn-off to Broad-street,) and terminate its career at the end of Plumtree-street, St. Giles's. We hope that this very diminutive improvement will never be carried into effect; indeed, we have few apprehensions that it will, as, in all probability, its execution would effectually prevent that of the very superior one which will otherwise, in all probability, take place in the course of a few years.

"A new street from Gower-street to Waterloo-bridge."

This is the continuation of Bow-street to the end of Charlotte-street, which the Commissioners of Woods and Forests

are understood to have resolved on, since they have made such considerable alterations at the Bow-street end of the line. The details, as they are given in this plan, are not of a very satisfactory character. As it is, the street from the bridge to Long Acre is remarkably crooked.

"A new street from Finsbury-square to the Commercial-road."

The great improvement wanted, with regard to the Commercial-road, is to continue it on to Aldgate High-street. The present plan has nothing whatever to recommend it.

"A new street from Holborn to the Strand, and taking down the houses on the north side of the Strand between the churches of St. Clement Danes and St. Mary-le-Strand."

The widening of the Strand in the part described might be desirable, but there is such a thing as making a street *too* wide, and in this case that fault would be particularly striking from the necessity, (unless St. Mary's Church be taken down, which will scarcely be proposed) of communicating after all by only a narrow isthmus with the other wide part of the Strand in front of Somerset House. With regard to the new street to Holborn, the plan here brought forward has more merit than most of its companions. It is to take the western side of Lincoln's-Inn-fields for part of the line, and at either end force a way into the main street nearest it. But the great advantage of selecting this side of Lincoln's-Inn-fields, instead of the eastern, seems to have escaped the projector. If the new way thus made into Holborn were continued across it for the length of 100 yards, it would enter King-street, and a direct communication, as straight as any street in London, would thus be effected between the Strand at Somerset House and the Hampstead-road. This new road is more eligible in every point than the proposed more western one by Gower-street.

"The improvement of the thoroughfare from St. Katharine Docks to Eastcheap."

This consists in the widening of the Tower end of Tower-street, and the pulling down of some projecting houses on Tower-hill. It would, no doubt, be a useful improvement.

"The removal of Middle-row, Holborn."

A scheme which hardly needed the assistance of a lithographic plan to make it intelligible. A street, as was before remarked, may be *too* wide. Holborn in front of Furnival's Inn is assuredly in that predicament; and if Middle-row be removed, some other object—a statue or public monument of some kind—will certainly be required on its site to mark the distinction between a street and a common.

"*County of Surrey.*—A new street from St. George's, Southwark, to Blackfriars' Bridge."

This new road is to be a continuation of the well-known line of Stamford-street, which, suddenly starting from the river-side, is, for some reason or reasons unknown, to make a desperate rush at St. George's Church in the Borough. A union with Tooley-street would be more in consonance with its previous habits.

"A continuation of the proposed new street from St. George's Church, Southwark, to Blackfriars' Bridge, Waterloo Bridge, and Westminster Bridge, and to the proposed Foot Bridge at Lambeth."

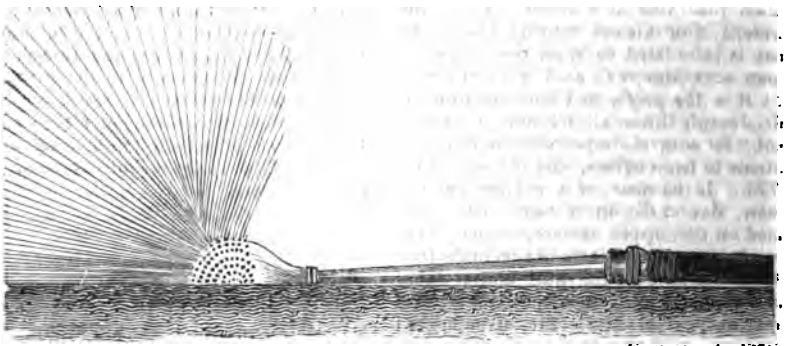
This recommendation must have slipt in by some mistake. The continuation alluded to is, as shown by the plan already in existence (with the exception of a branch to the Foot Bridge), under the name of Stamford-street.

These, then, are the improvements proposed which the Committee calculate may, with the purchase of the interest of the proprietors of Waterloo and Southwark Bridges, be effected for a sum not exceeding 1,2000,00*l.*, but which they, duly considering the uncertain nature of estimates, require 300,000*l.* more to begin with.

The reader who has followed us thus far will, we think, be unable to repress a feeling of disappointment at the results of the Committee on "Metropolitan Improvements." A commonly attentive glance at a map of London might, one would think, have suggested proposals far superior to any they have recommended. It is said that the central avenues of the City are choked up with too abundant traffic. Does not the map explain this? To the westward there are two great thoroughfares towards the centre—the Strand and Holborn; to the eastward there are also two—the Mile End and Commercial Roads; but in the centre itself these great roadways con-

verge into one, and Cheapside is made to bear all the burden of all the commerce that traverses these grand avenues from east to west. The remedy is obvious; at least, one other line of way to the north of Cheapside is called for. The map will likewise show the great deficiency of lines of road from north to south, there not being one, with the exception of Bishopsgate-street and its continuations, that fairly traverses the metropolis. For one of these desiderated thoroughfares, an excellent line is pointed out in this evidence (by Samuel Mills, Esq., a Commissioner of Sewers), in a continuation of Old-street to Theobald's-road, and so on to Oxford-street; another was suggested years ago by Mr. Nash in his proposed improvements of St. Martin's-lane, so as to communicate at one end with Charlotte-street, at the other with Whitehall. Had the Committee kept a few great objects like these in view, and carefully considered plans to effect them, not only consulting the utility which ought to form their chief feature, but the beauty which, under able management, they might be made to present, they would have done honour to themselves—rendered an essential service to the City and the citizens—and not have thrown away the public money by having plans engraved for new streets from Newgate-street to the Post-office.

BRAMAH'S PERFORATED BOSS FOR FIRE-ENGINES.



Sir,—In London, where fires are of very frequent occurrence, the experience of the firemen enables them to attain great skilfulness in their method of dealing with that destructive element. From constant practice they are enabled to approach so close to the burning materials, as to deliver their engine-streams point-blank upon the very heart of the fire, even in the midst of such quantities of heat and smoke, as would render it impossible for less practised persons to keep their ground for an instant.

It not unfrequently happens, however, that persons have the care of engines and are called upon to extinguish fires, whose opportunities of acquiring the needful experience in these matters is exceedingly limited, and they therefore seldom make the best use of the means at their command. A striking instance of this sort occurred about four months back at the Bank of England. There are no less than seven excellent fire-engines kept within the walls of the Bank, which are inspected by the maker every month, and there is in every department a good supply of leather fire-buckets. In each of the yards capacious tanks are judiciously placed and kept constantly filled with water. There is a nightly guard of thirty-two soldiers sent from the Tower, besides which, a number of the porters, of the principal clerks and other officers of the establishment, constantly reside in the building. Notwithstanding all these admirable arrangements, and the presence of this considerable force, upon the occasion of the recent fire, they battled with it for nearly an hour, and finding themselves gaining no ground, they sent for the assistance of the London fire-establishment. When the firemen arrived they found the men belonging to the Bank

working their engine from the outside of the building, through an open window of the room *at the further end of which* the fire was at the time raging; much labour and a quantity of water was thus uselessly expended, and falling upon some valuable machinery in the room did much injury.

The moment the firemen ascertained the nature of the danger, they seized the branch of the engine, dashed through the window into the room, and advancing close to the burning timbers, poured the full stream of water thereon, and soon extinguished the fire. Instances of this kind are of constant occurrence, and it is rather surprising that some contrivance has not been adopted that would obviate some of the dangers and difficulties of the case. It appears to me, that there is an invention of long standing, though fallen into complete disuse, and at the present time almost entirely unknown, that is calculated to be eminently useful upon occasions such as I have referred to; it is *the perforated boss or nose* of Mr. Joseph Bramah, included in his patent "for several improvements and additions to fire-engines," dated April 18th, 1793. It consists of a copper hemisphere, flat on the under side, and perforated on the upper surface, rather more than half way over; it screws on to the top of the branch-pipe the same as any other kind of nozzle, and throws the water in a great number of minute streams in every direction, as shown in the accompanying sketch. Mr. Bramah, in his specification says, "this boss or nozzle is meant to be used in such cases as will admit of a man approaching to the part where the fire is first begun, or at any other period when deemed useful."

Were an engine furnished with one of these perforated nose-pipes, although the person in charge of it, from want of practice, was unable to *remain* in the apartment where the fire was raging furiously, yet he might run in, drop the branch thus equipped, and then retire; the effect of working the engine would be to deluge all parts of the room, and most effectually in an incredibly short space of time, to extinguish the flames.

Even the bravest and most expert fireman might often use this apparatus with advantage, for it frequently happens that a fire has attained such a head in a particular apartment, as to defy any living creature to remain many seconds therein. In such cases the fireman might boldly enter, and having placed his branch, withdraw; in a few minutes he would find the fire almost, if not wholly, extinguished—the atmosphere of the room cooled down to a bearable temperature, and the greater portion of the smoke condensed or dissipated—and all this done with the smallest quantity of water.

The firemen occasionally spread the water by putting their thumb on the orifice of the branch-pipe, but it is done very imperfectly in this manner, and can only be attempted upon occasions when the firemen can remain in the room. By means of a long pole, the branch, equipped with the perforated boss, may often be pushed along into places where it is utterly impossible for a man to enter, and in a very short space of time would make a position tenable, from which the fireman might follow up the advantage thus gained. I am quite of opinion that the general employment of Bramah's nozzles within buildings, would greatly expedite the suppression of fires, and very materially reduce the amount of damage done by water.

I am, Sir,
Your obedient servant,
W. BADDELEY.

London, Feb. 23, 1837.

MR. MACKINTOSH'S ELECTRICAL THEORY.

Sir,—Mr. Mackintosh is not satisfied with the method I pointed out to him (No. 705) for obtaining information respecting the first question he put to me (No. 693), namely, to give him a demonstration of "what produced the first impulse?" I referred him to his own Pastor for a solution of his own proposition. Indeed, it struck me at the time, that the question was not altogether a proper one for the *Mechanics' Magazine;* and farther, as Mr. Mackintosh has taken good care not to answer some questions I put to him on his Electrical Theory of the Universe, I conceived I had no right to answer his. But in consequence of some remarks he has thought proper to make in his last letter (No. 708), I beg leave to offer a few remarks on the first question, and also upon the second, as he

conceives them to be of such great importance as to involve the truth or falsehood of the whole system: but whether he means his own mighty system, or that of poor Newton's, I cannot tell.

Question.—What produced the first impulse?

In the way this question is put, Mr. Mackintosh assumes that matter must have existed before motion, or there must have been a time when all the matter in the universe was in a state of absolute rest; in that case, I should have no hesitation in saying (and his Parson would have told him the same, and saved me the trouble)—since no change can take place in nature without a cause, the first impulse must have been produced through the agency of a supreme Being.

Had Mr. Mackintosh pondered sufficiently upon the above question, he never would have philosophised in the way he has done. Perhaps he meant to have said, "Had matter and motion ever a beginning? If not, can their existence be or not be dated from the same period of time?" &c. Here I might have had something to grapple with, and not a mere shadow; but I have no right to put words in his mouth.

Mr. Mackintosh then proposes this second important question—"From what force is the motion of the heavenly bodies derived?" That force which could impart motion in the first instance, can sustain that motion, and is required to do so, as otherwise the motion would be quickly annihilated by the action of gravity.

Here, again, I am sorry to inform Mr. Mackintosh, that this second question has no great pretensions to absolute wisdom. I am afraid his perpetual motion wheel has so completely absorbed all his other faculties, that he has not only forgotten his knowledge of the Newtonian system, but that he is a little rusted in his own system. Well, I must endeavour to rouse him up a little.

The answer to the first part of Mr. Mackintosh's question is—*Gravitation*; and with regard to the second part, Mr. Mackintosh surely has not forgotten that the heavenly bodies, belonging to the solar system, revolve round the centre of gravity of the said system. But let us simply consider the case of our own planet. When the earth is in that part of her orbit nearest to the sun, the gravitating power, or the attraction which the sun has upon the earth, is a maximum; the consequence of which is, that the velocity (and consequently the momentum) at the said point is also a maximum. But when the earth is in that point of her orbit most remote from the sun, the velocity and momentum become a minimum, that is, as the gravitating force of the sun acts more and more upon the earth, the centrifugal force of the earth is increased, and conversely; so that, far far from the motion of the heavenly bodies being annihilated by gravitation, it is, in fact, gravity that regulates and preserves all their motions. Suppose the gravitating force of the sun were to be destroyed, then the angular motion of the planets would immediately cease, and what would be the result? The answer is easily given—the whole race of inhabitants belonging to the solar system would be (not roasted, but) frozen to death. And all this is demonstrated by Newton, in his "Principles of Natural Philosophy," and has been amply confirmed by observations. I again repeat, that it was study and observations that led Newton to a knowledge of gravitation.

In conclusion, I beg to state that there is no such thing in nature as absolute rest; place a body as far as possible from any other body or bodies, still it will be within the influence of their gravitating powers, and without any impulse it will immediately commence motion.

Your obedient servant,

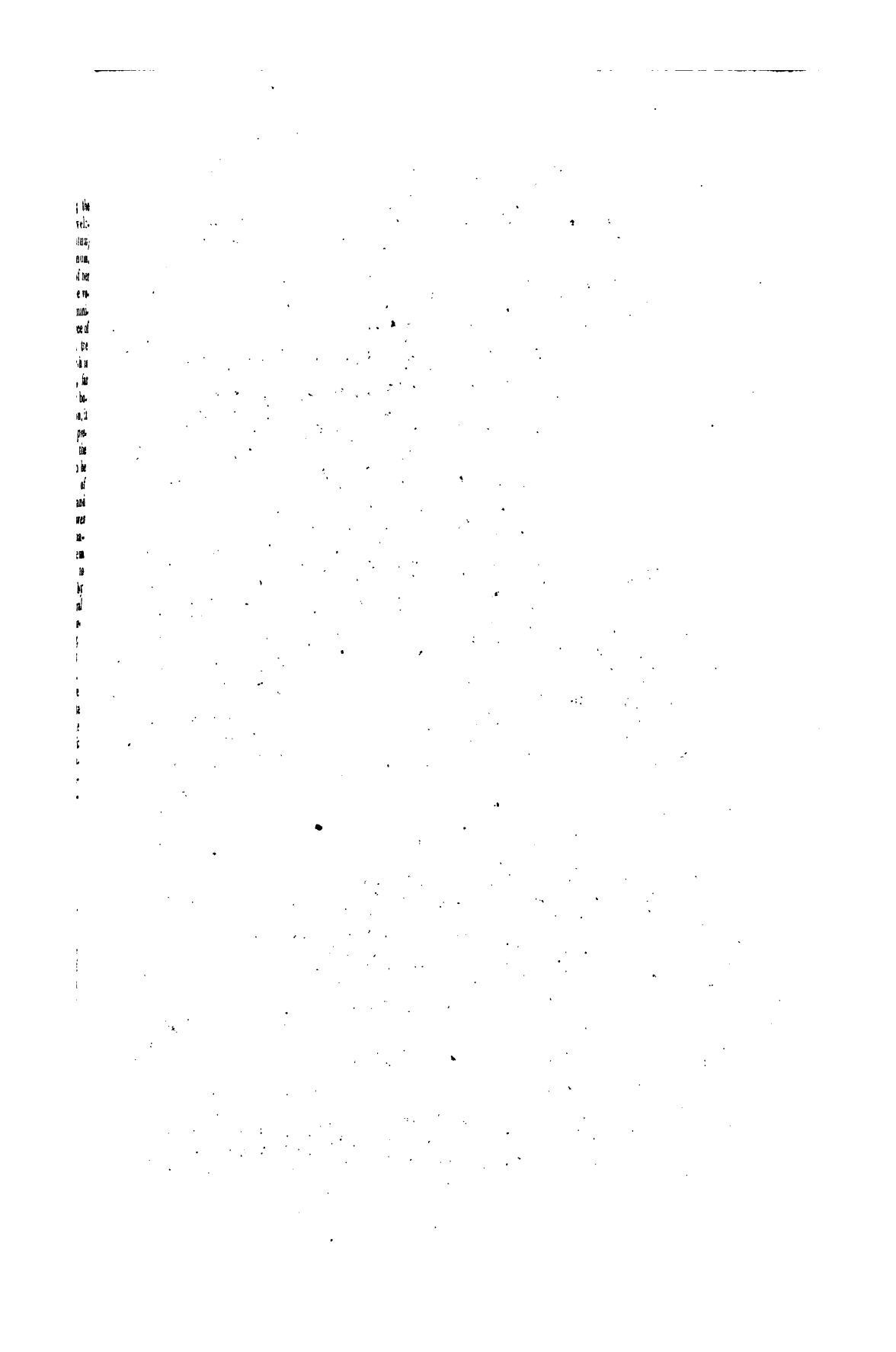
KINGLAVEN.

March 4, 1837.

SOLUTION OF A TOWN-TEACHER'S MATHEMATICAL QUESTION. BY O. N.

Question.—"The late Dr. Hamilton, of Aberdeen, in his excellent 'System of Arithmetic,' asserts, that the interest of 1,000*l.* at the rate of 5 per cent. per annum, on the principles of compound interest, for half a year, is only 24*l.* 13*s.* 9$\frac{3}{4}$*d.* How can this be, when the simple interest for the same sum, at the same rate and time, is 25*l.*? Perhaps some of your algebraical correspondents will be so kind as to explain this (to me) seeming paradox."

Solution.—The Town-Teacher remarks, that the interest of 1,000*l.*, at 5 per cent. per annum, is 25*l.* for half a year. I



SPECIMENS
OF
ENGLISH MEDALLIC ENGRAVING.

EXECUTED BY J. BATE BY MEANS OF HIS PATENT ENGRAVING MACHINE.

For the Mechanics Magazine Vol. XIV

deny this position, for the following reason:—Suppose A owes B 1,000*l.*, and A agrees to pay B 5 per cent. per annum, that is, 50*l.* at the end of each year? Then, I say, B has no right to demand 25*l.* from A at the end of six months; for on the supposition that A was to pay B 25*l.* at the end of six months, he would lose the interest of 25*l.* for half a year, therefore A ought only to pay B (if he chooses to accommodate B with half a year's interest six months before it is due) such a sum as improved at 5 per cent. per annum would amount to 25*l.*—which sum, by rule of discount, will only be 24*l.* 7*s.* 9½*d.* So much for the simple interest case.

2d. In the case of compound interest, assume 1000 = P, R = amount of 1*l.* for 1 year, x = amount of 1*l.* for half a year; then, by the principles of compound interest,

$1 : x :: P : Px$ = amount of £P for half a year, and $1 : x :: Px : Px^2$ = amount of £P for one year; then, by the question,

$$Px^2 = PR, \text{ or } x = \sqrt{R}$$

Let i = interest due at the end of half a year, then

$$i = Px - P = P(x-1) = P(\sqrt{R}-1)$$
$$= 1000\,(\sqrt{1{\cdot}05}-1) = £24{\cdot}69 = £24\ 13s.\ 9\tfrac{3}{4}d.$$

And this is the answer given by Dr. Hamilton. It may, however, be observed, that had the decimal been carried to one place more, it would have been £24·695 = £24 13*s.* 10½*d.*, being 1*d.* more than that stated by a Town-Teacher. It, therefore, appears to me, that Dr. Hamilton must have solved the question upon true principles.

I am, Sir, yours, &c.

O. N.

P. S.—I could not help admiring the dexterous way your correspondent, R. Evans, or rather his friend, the Actuary (Mr. Williams), extricated himself from the false solution he gave of the distance travelled by Mr. Green's balloon in his great Continental trip (see Nos. 695 and 704). His last corrected formula is tolerably exact for certain latitudes and longitudes; but many examples might be given where the true distance does not exceed 359 English miles—but if calculated by the principles of taking the middle latitude, would produce errors amounting to between 59 and 60 per cent.

MEDAL ENGRAVING BY MACHINERY—THE ENGLISH AND FRENCH PROCESSES.

Sir,—If it were not unhappily the case that the "fantastic tricks" played by Committees of the House of Commons are but too often of an entirely inexplicable character, the very highest degree of surprise might naturally be excited at the method adopted by the British Museum Committee to dispose of the "Medal Engraving by Machinery" question—or rather to avoid disposing of it at all. The evidence adduced is of such a character, as to establish the superiority of the British process over that of Collas beyond the possibility of a doubt; while the other disadvantages attending the project set forth in the petition referred to the consideration of the Committee, are so numerous, and so obvious, that they scarcely require more than to be barely stated to insure (at any rate when taken in connexion with the former fact) its instant condemnation. And yet, after all, the Committee contented themselves with reporting the Evidence alone, without giving any opinion on the matter! If this were the course usually pursued when the case was so plain that it might seem a work of supererogation for a parliamentary jury to deliver a verdict in full form upon it, every thing would be accounted for; but I believe it is not so—that, when a Committee decline giving an opinion, it is to be inferred either that they have not sufficient grounds for coming to a decision, or that the members are so equally divided in sentiment, that any thing like unanimity is not to be looked for. Yet it is hard to believe that the Committee could be in any such predicament on the occasion in question. The balance of testimony is so enormously in favour of Mr. Bate's process, that nothing less could have been reasonably expected than that the Report should have strongly recommended him to the patronage of Parliament, (in case Parliament should think it fitting or necessary to extend its patronage to any scheme for engraving the medals in the Museum,) and advised his French rivals to return to the place from whence they came. It may be an uncharitable notion, but certainly, all things considered, it is not altogether an outrageously absurd one, to suspect that, had Mr. Vincent Nolte and his backers gone on to the end of the in-

quiry as swimmingly as at the beginning —had they been able to keep the British method as completely in the back-ground as they evidently intended to do—or, better still, had the foreign process turned out to have the advantage instead of the English one—the Report would have concluded in a widely different fashion, and that by this time, we should have had some "liberal" M. P. signalizing his zeal for economy, by rising in the house, and proposing a grant of a few thousands towards the expenses of so truly national a work as a "Histoire Numismatique de la Grande Bretagne," got up at Paris by "Lachevardiere and Co.," with the assistance of the wonder-working "*procédè de Achille Collas!*"—As it is, the tables are completely turned—the English process comes triumphant from the scrutiny, and—*the Committee report the evidence.*

Many readers of the *Mechanics' Magazine*, puzzled to account for this conduct of the Committee, have, I know, been inclined to think that, as an abridgment only of the evidence appeared in its pages, the omitted portions may have been more favourable to the French cause than those which have been retained. The fact however, as you, Mr. Editor, must be pretty well aware, is rather the reverse. In pity, perhaps, to Sir Francis Chantrey (whose ignorance on the subject on which he was brought up to give his testimony is most amazing), the abstract omits the whole of that part of his examination relating to the engraving of the medallion of Sir Walter Scott, which threw so much light on the great value of his opinion on the matter. Pitiable, indeed, it must have been to hear a man of the high eminence of Sir Francis testifying in one breath to the accuracy of the French method, and, in the next, acknowledging the distortion it produced, and observing apologetically that he had never observed it till that moment, when it had been pointed out to him by a member of the Committee! The whole affair, as far as he is concerned, gives but a low idea of the confidence to be placed in the mere dictum of a professional man, however high he may be. Sir Francis Chantrey is a first-rate sculptor: he is brought forward to enlighten the unartistical world as to the merits of medal-engraving by machinery;—*of course* he is well acquainted with the subject, and, equally *of course*, his opinion may be relied on with perfect confidence. Well, his opinion is given *ore rotundo*, and with all gravity;—the engravings by M. Collas' method he pronounces, are "satisfactory" and "faithful." What next? A member of the Committee produces one of these very engravings, requesting the attention of Sir Francis to certain parts of it; *then*, for the first time, his practised eye recognises "distortion," or, at least, "deviation," in place of "accuracy;" our great sculptor expresses his surprise at his own surprising want of observation, thereby virtually acknowledging that the opinion he had just given was not worth a rush; and the great enlightener of the world in general, is forced to own that he has come so well prepared for his task, that half a minute's observation is quite sufficient to upset all the conclusions drawn from the sum-total of his experience on the subject! How was it possible after all this to cap the climax? Probably in no other way so well as by *sending a letter next day* to the Chairman of the Committee, informing him that, *since* giving his evidence he has discovered that "there are several machines in this country which produce copies of medals in true proportions in all their parts." So then, at the time when Sir Francis was thrust upon the Committee to give his evidence, he was actually in so inconceivable a state of ignorance upon that very subject, that he had never even heard of a process so well known to all the world, and especially the world of art, as that of Mr. Bate! Truly, as they say in Persia, "there is darkness under the lamp;" from the whole tenor of Sir Francis Chantrey's unfortunate testimony, it should seem that the last person who ought to be applied to for information or opinion on a point of art is—an eminent artist!

Another passage unfavourable to the French party, omitted in the abstract, is a certain reply of Signor Pistrucci. The worthy Signor endeavoured to steer a middle course, by allowing to each process its peculiar merit: giving to the English machine the palm of absolute correctness, but at the same time averring that the French produced the greater effect, by giving a sort of perspective view; yet, when closely pushed, and asked, whether, if an engraving by hand of one of his works were to be executed,

he would direct the artist to give a *correct*, or a *perspective* view, he was obliged to reply that the former would be his choice, as a matter of course. This reply turned the scale of his evidence, reluctantly enough, in favour of the English method, and should consequently have found a place in the abridgment of the evidence, although its omission is of the less consequence that it only adds weight to the already preponderating side. Had it been the other way, you would, probably, have heard something of the matter ere now, from the truly indefatigable Mr. Vincent Nolte.

With these little exceptions, nothing of the least importance has been left out in the abridged evidence; so that there is still as much room as ever to wonder at the "lame and impotent" non-conclusion of the Committee. The whole proceedings on the petition bear very much the appearance of a trial, "Collas *v.* Bate;" and how the Jury could avoid finding for the defendant, it is not easy to say. The case for the plaintiff, indeed, went on pretty swimmingly at first (to tell the truth, he thought he had taken the defendant by surprise, and that he would not appear till too late); but, as we have already seen, one of his witnesses broke down in a most distressing manner, while some of the rest managed to contradict each other rather awkwardly; and when the other side took their turn, the game was up at once, and the feeble reply of Counsellor Nolte, for plaintiff, only served to show that he was put quite "out of court," and must either consent to a non-suit, or expect a verdict against him. That the Jury should content themselves with "summing up the evidence," and separating without a decision, was a casualty not to be looked for.

It is singular enough that every averment of any consequence in the original petition of Mr. Tilt, as well as in that gentleman's evidence, was contradicted in the course of the inquiry, very often by the witnesses on his own side. The petition informed the house that the French machine could "accurately" transfer the relief of a medal to a plane surface, "so as to effect the eye in *precisely* the same manner as the original," and that it performs its duty with "the most *minute precision*." To support this, Sir Francis Chantrey was put forward, and we have already seen what he did for the cause. Mr. Hawkins, the next witness (who was to have executed the literary portion of the proposed work, and was therefore not disinclined to speak as favourably as might be of Collas' process), employs himself in softening down the admitted "distortions" as much as possible. "In high relief," he tells us, "it is not distortion of the line to produce an effect, but actually *distortion*—yet nothing offensive to the eye!—As for Mr. Nolte, his explanations, after Mr. Brockedon's evidence, clearly showing the cause of this awkward effect, are quite sufficient to enable any "intelligent jury-man" to make up his mind at once. He first "accounts for the discrepancy" by the "shrinking of the brass casts"* from which the machine works; and immediately after, as if forgetting the assertion of the moment before, assures us that the same discrepancy "merely arises from the view taken by the artists of the manner in which the medal is to be engraved." In either case, what becomes of the "accuracy," the "minute precision," vaunted of by Mr. Tilt, but absent without leave in all the specimens of Collas' process exhibited to the Committee, and found only in those produced by Mr. Bate's?

It is the same throughout. There is probably not a single assertion advanced on the French side of the question, which is not contradicted by one or other of their own witnesses, or completely disproved by the opposite party. Mr. Nolte, for instance, accounts for the great distortion in the engraving of a medal of Pierre Jeannin, by the shrinking of the brass cast, and puts up Mr. R. Faraday to support his view of the case. How does he support it? Simply by observing, that he "*does not think it possible* that the distortion in the medal of Pierre Jeannin can be accounted for by the *contraction of the metal*." Again, Mr. Tilt proclaimed it as one of the merits of the French machine, that it did not re-

* And be it remembered, if the French proposals had been acceded to, it was proposed to *take casts* here, send them to Paris to be engraved, and then import the plates from Paris to be printed here! A rather roundabout way, especially when we have a better process, and better artists at home; to say nothing of the additional chance of inaccuracy incurred. Another *advantage* would be, that the honour of the French company must be implicitly relied on for the completion of the work in the same style as the commencement, as, observes Mr. Tilt, "it is extremely difficult to take any indemnity from foreigners in a foreign country."

quire the superintendence of an artist: Mr. Nolte claims the preference for the same side, on the ground that the engravings could be executed better in Paris than in London, from their being in the latter "*superintended by artists appointed for the purpose!*"

Mr. Tilt "was not aware of any individual in England who has a machine that would engrave the plates with sufficient accuracy and rapidity." The Committee, however, had a better opportunity of acquiring information on this point than the worthy publisher-expectant of the grand Government-supported work that was to be; they found, by the admission of Mr. Tilt's own friend, the great representative of Lachevardière and Co. himself, that, while Collas' machine produces "distortion" (whether necessarily or of choice), the only machines that *can*, or at least *do*, "engrave plates with (not only 'sufficient' but perfect) *accuracy*" are to be met with in "this country" only! With reference to "rapidity," they also had a tolerable opportunity of forming a judgment, when the engraving of a large medal was put into their hands in the morning, which had been commenced by Bate's process on the previous afternoon! Mr. Tilt dwelt not a little on the cheapness of the French method, but even here the English need not dread comparison. Mr. Nolte informed the Committee that, for a plate of the Soane medals, for which Mr. Freebairn received forty-five guineas, the firm he represented would consider themselves well paid at eight guneas only: on the other hand, "the seal of the Athenæum club, for which Mr. Lane charged forty guineas, Mr. Bate said he would engrave for *one pound*; if a number were to be done, one-half would be sufficient—one pound per medal, obverse and reverse." Thus the positions of the enemy were turned at all points.

In a word, all the excellencies attributed to the French machine were fully proved not to belong to it, but to be possessed by its English rival; above all, the merit of entire and scrupulous correctness, so highly essential to such a work as that projected, and without which half its value would be lost, was conceded to be the peculiar property of the latter. Every possible consideration pointed out the preference due to the *native machine*, and yet the result was, that the Committee "reported the Evidence to the House." To account for this result must have puzzled many heads besides that of,

Sir, your very obedient servant,

H.

London, March 8, 1837.

CONTINENTAL RAILWAYS.

The railway system does not appear to be progressing very rapidly on the Continent, partly, perhaps, owing to the difficulty, owing to the great demand for both home and foreign consumption, in obtaining the rails from the great storehouse—England. Unless affairs take an unexpected turn, the South-Eastern Railway to Dover will be completed long before that from Calais to Paris is ready to receive its share of the traffic between the two greatest capitals of Europe. The latter has as yet only been talked of, but hopes are now expressed that it will shortly be commenced in real earnest, as it is asserted that an iron-founder at Anzin has at length succeeded, after numberless attempts, in casting rails of a weight and strength equal to the English, and thus relieved his country from the necessity (in the matter of railways at least) of "paying tribute to foreigners," a consideration which seems to have weighed much with our ex-hereditary enemies against the advantages of the system; as to the necessary capital, no doubt is entertained, or, at any rate, expressed, that three times the requisite amount would be forthcoming at the first call. If all this be correct, it is indeed high time to begin the work. With respect to common roads, France is in a most deplorable state; it is admitted on all hands, that the cross-roads throughout the kingdom have been so neglected as to become at last absolutely impassable; and it has actually become a question of national interest by what method they can be made worthy of the name of "roads," at an expense within the means of the various *communes*, or rural districts. In the department of Creuze, it is said, there are abundant mines of excellent coal, which is sold at the pit's mouth at a very low price, but which is of no service even to the immediate neighbourhood, because there is no road in the district passable by the very simplest

wheeled vehicle! At this rate, railways in France will have nothing to fear from competition.

From Germany the report is more favourable. The King of Prussia has abrogated the peculiar privileges of the Post-office in his kingdom, which interfered most materially with the interests of railway projects—and two grand lines are forthwith *to be* commenced, which *are to extend* to a distance of no less than 100 German leagues! Great dissatisfaction, it appears, has been excited among the Prussian iron-masters in consequence of the contracts for the Berlin and Potsdam Railway having been taken by English houses; although it is at the same time notorious, that there is no native establishment sufficiently extensive to undertake the execution of the order within the stipulated time.

In Russia, the Tsarskoeselo and Pawlowsk Railway is going on swimmingly. On the 5th February, three locomotives were put in requisition for the conveyance of the Cockneys of St. Petersburgh to a fête at the "Vauxhall" (there are Vauxhalls every where!) at the country end of the line. Each engine drew a train accommodating 340 passengers, and performed the trip ten times, amidst a vast concourse of spectators, attracted by the novelty and the fineness of the weather. The receipts from passengers (at 80 and 40 copecks each) amounted to 1,046 rubles (upwards of 40*l.*), while the Company derived a profit, as proprietors of the "Vauxhall" of 1,100 rubles more. If so much could be effected by the attraction of a fête in the middle of winter, the Company may reasonably expect to do wonders when summer (albeit a Russian one) smiles on their undertaking, and allures the Petersburghers to their favourite country resorts.

ANIMATION OF HORSE-HAIRS BY GALVANISM.

Sir,—In your Number of March 4, is a letter from Colonel Maceroni, entitled, "Production of Life by Galvanism—Animation of Horse-hairs." Colonel Maceroni says, that "Dr. Foster assured him that at the end of three weeks' submission to the galvanic influence, the hair had increased to the size of a thick straw, and gave him satisfactory proofs of real identical vitality."*

* * * * * *

It would, in short, be giving a creative power to an *effect* which is contrary to reason.

Probably the immersion in water and the action of the galvanic pile caused the tubular horse-hair to swell and form a nidus for those imperceptible larvæ which are common in pond water, in which Colonel Maceroni informs us the hair was immersed. The vitality of these larvæ may have given the living appearance, so satisfactory to Dr. Foster, and thus the mystery is naturally solved, and the idea of an effect having the power of creation, shown to be hastily assumed by Dr. Foster, and inconsiderately promulgated by Colonel Maceroni.

I am, Sir,

Your obedient servant,

N. Ogle.

March 13, 1837.

NEW STEAM-BOILER.

Sir,—Having discovered a means of generating steam by a system at once exceedingly powerful, safe, of comparatively light weight and small size, I beg to call the attention of the scientific readers and others of your Journal to its astonishing power; and to state, that I am desirous of relinquishing wholly, or in part, my interest in its use. A 60-horse power-boiler will measure 2 feet 6 inches long by 1 foot diameter, and will weigh under 2 cwt.; a 600-horse power will measure 6 feet long by 4 feet diameter, and will weigh under a ton. Incredible as these results may appear, they are quite certain, and rest upon well-known principles; and is, therefore, for locomotive-engines and steam-navigation particularly, highly valuable.

I am, Sir,

Your obedient servant,

G. L. Smartt.

Enfield.

* We have taken the liberty of omitting part of our correspondent's letter, which would have been apt to lead to a metaphysico-theological discussion, which we are anxious to avoid, as being unsuitable to our pages.—Ed. M. M.

NOTES AND NOTICES.

Railways in London.—The extension of the Birmingham Railway, from the originally-intended terminus at Camden-town to Euston-grove, near the New-road, is progressing rapidly, and the scaffolding is now erected for the stupendous portico, which is to be composed of six columns, of the enormous height of forty feet, and proportionable thickness! The railway crosses the Hampstead-road and Park-street (leading to the east gate of the Regent's-park), in an excavation of the depth of from twenty to thirty feet, although, at no great distance, it is carried over the Regent's canal at a height sufficient to allow the passage of barges below. The London Grand Junction Railway, which is to leave the Birmingham at its original terminus, and carry on the line to the verge of the City, has also been commenced with considerable spirit, nearly at the back of Messrs. Cubitt's, the contractors, in Gray's-Inn road. It is, at that part, at least, to be carried on arches, after the fashion of the Greenwich Railway, and very little progress can be made in the line either way, from the present site of operations, without pulling down houses and buildings of very modern erection. Its course will, in general, follow that of the *celebrated* River Fleet, whose channel, which within a short time saw "the light of day" in that vicinity, is now covered over there, as well as in most other parts watered by its "tran-lucent streams."

A Removal Westward.—The new National Gallery in Trafalgar-square is so far advanced towards completion, as to justify the announcement that the exhibition of the Royal Academy this spring will take place within its walls. The usual notices to intending exhibitors have been issued, with the intimation that their works are no longer to be sent to Somerset House, where the rooms lately occupied by the Academy have been, it is understood, appropriated to the use of the Council of the newly-chartered University of London.

"*Practical Science.*"—The subjects to which the greatest degree of attention has been paid in the lectures at the London Mechanics' Institution, since its establishment, have probably been—Phrenology and *the Drama!*

While the question as to *steam-communication with India* by the Red Sea remains so long in abeyance, the East India Company are continually adding to their steam-fleet in the east, by sending out new steamers by the Cape of Good Hope. Two are now actually on their way thither, one of them fitted out as a vessel of war, and destined to act against the pirates who infest the Indian seas.

The Importance of Time-Keeping.—The topography of watch-making, at home and abroad, would present a vast number of curious and interesting facts. In consequence of the minute subdivision of labour in this trade, it is said that there are only three places in the United Kingdom where a complete watch can be manufactured,—London, Liverpool, and Coventry. The business has been introduced at the latter place entirely since the year 1800, and the number of persons employed in it there is now supposed to equal the number in the metropolis! There are innumerable places, besides these, where some part of the manufacture is carried on: the town of Whitchurch, in Hampshire, for instance, is employed entirely on the making of *hands!*

The Thames Tunnel.—According to the Report of the Directors at the last meeting of the Thames Tunnel proprietors, the "great bore" has been driven *one hundred and thirty feet* nearer the Middlesex shore since the works recommenced, so that in a short time it is anticipated the low-water-mark on the Wapping side will be reached, and the completion of the undertaking made a matter of comparative certainty.

Railroads in Belgium.—M. Nothomb, the Minister of Public Works in Belgium, has just laid before the Chamber of Representatives, a return of the railways to be formed in the kingdom at the expense of the Government. They extend along 115 leagues, having their central point at Mechlin. They consist of two principal lines, one from the French frontier to Antwerp by Brussels, and the other from Ostend to the frontier of Prussia near Aix-la-Chapelle, by Ghent, Mechlin, Louvain, Liege, and Verviers. When the King of Prussia has authorised the projected elongation, Antwerp and Ostend will be brought into communication with the Rhine and Cologne.

Progress of River Navigation.—It is scarcely half a century ago since the tilt boats for the conveyance of passengers to and from London to Gravesend were, in shape and speed, just what the Trinity-house ballast-lighters are at present, and taking four tides or more for the completion of the voyage. They were succeeded by the Dundee boats, which were, as fast sailers, both the wonder and admiration of all who witnessed the improvement. They, however, were of the most inconvenient nature, as the passengers were frequently not only called upon to embark in the middle of the night, in order to have the first of the flood; and after tacking and beating about, together with sometimes too much wind, too little ditto, or none at all, besides being huddled in a low and uncomfortable cabin, were frequently, after six or seven hours on the water, compelled to land at Woolwich, Blackwall, or Greenwich, and then have to find their way in the best manner they could to the metropolis. At length the progress of science introduced steamers for the ferry, which, however, at first, generally took from five to seven hours to arrive in London, a length of time it was evidently a desideratum to lessen. On Sunday last the Diamond started from the Pier at four P.M., proceeded to London, landed her passengers, returned, and at nine minutes before eight o'clock was at her moorings *off* the Town Pier; thus performing the two voyages (64 miles), including stoppages, in three hours and forty minutes.—*Kentish Observer.*

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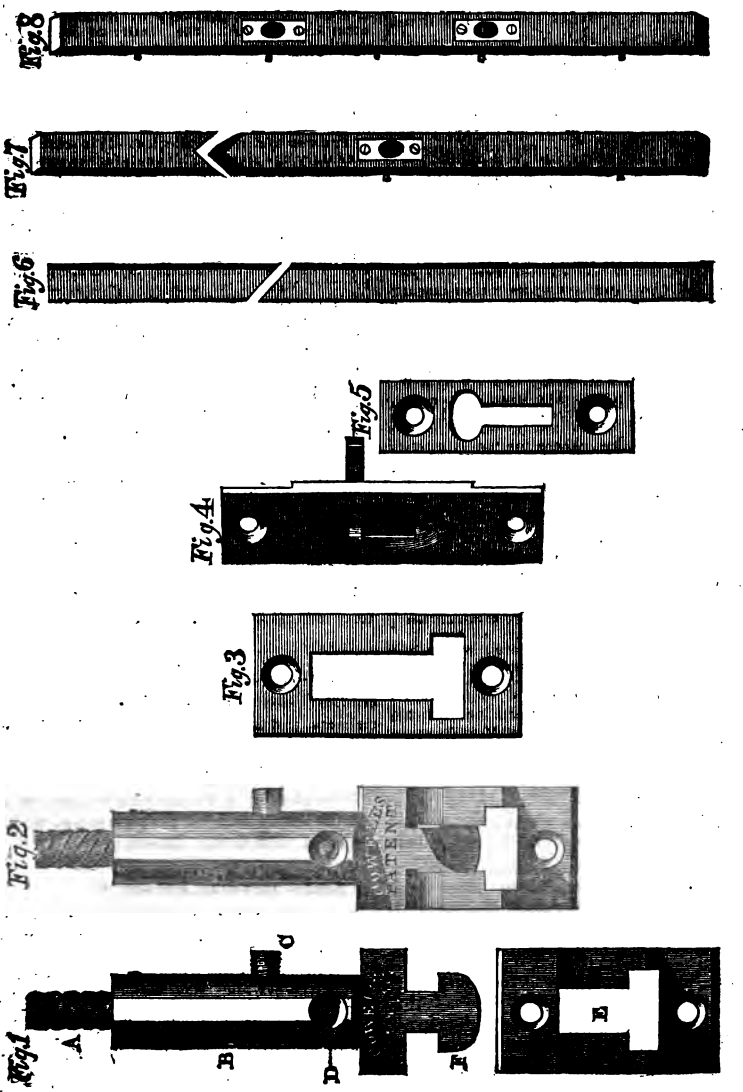
COWELL'S PATENT SASH-SUSPENDER.



COWELL'S PATENT SASH-SUSPENDER.

The practice of masters and mistresses either compelling or allowing female servants to clean house-windows on the outside, by standing or sitting upon the ledges, has often called forth the animadversions of the humane and considerate, and numerous plans and suggestions have at various times been brought forward to lessen or remove the acknowledged danger. Our intelligent and valuable correspondent, Mr. Baddeley, has frequently and loudly protested against this inhuman custom, and has pointed out some very ingenious methods by which the evil might be in some degree remedied; but in all the plans that have heretofore been brought forward the main objection still existed, namely, the servant or workman having to go outside; by whatever contrivance supported, there was still the danger of that contrivance breaking or losing its hold. Mr. Cowell's very ingenious and simple sash-suspender entirely does away with the necessity of any outside work whatever. In windows fitted with his apparatus the sashes can be immediately detached from the lines, and taken into the rooms or to the kitchen to be cleaned in a much more convenient, and, consequently, more perfect manner—to say nothing of the entire absence of danger.

There can now be no excuse for the lives of human beings being put in danger—the cost of Mr. Cowell's invention being but a trifle—and from this date we call upon all jurymen, who may sit upon any inquest touching a death by a fall from a window while cleaning it, to return a verdict, not of accidental death, but of culpable homicide against the master.

Description.

Fig. 1, A, the sash-line; B, the socket that receives the sash-line; C, the screw that presses the spring within to secure the line; D, an aperture to show that the line is at the bottom of the socket; E, a plate, or eye, to be let into the sash to receive the hook F. Fig. 2 shows the hook F and plate E attached. Fig. 3, a plate to be let into the sash-frame, at a convenient height, to receive the hook F (fig. 1) when shifted from the sash, to prevent its running up to the pulley out of reach. Fig. 4, a flush bolt to be let into the bead to fix it instead of nailing. Fig. 5, a plate to be let into the sash-frame for the bolt to lock into. Fig. 6, the parting bead. Figs. 7 and 8, the 5-8ths, or outside bead.

Directions for Fixing.

Insert the end of the sash-line into socket B (fig. 1), when seen at D, turn the screw C. Sink plate E into the end of the sash, above where the line is usually nailed, and mortice sufficiently to admit the whole (fig. 2) to lay flush; the top of socket B may come within one inch of the pulley. Let a plate (fig. 3) into each side of the sash-frame to receive the hook F (fig. 1) when shifted from the sash; one plate is made to accommodate two suspenders, holding them both within reach until they are again wanted; they may be placed about eight inches above the meeting rails of the sashes. Cut parting bead, as shown (fig. 6), so that two-thirds take out and in, fixing in its place the top piece with brads. Cut five-eighths or outer bead, as shown (fig. 7), fixing the upper portion; three-fourths of this bead (say the one on the left hand) must be moveable; one dowell about nine inches from the bottom, and one bolt (fig. 4) a little above the centre, will fix it as firmly as nailing; if the whole of the bead be made to shift, three dowells and two bolts must be employed, as seen in fig. 8; this mode is preferable for parlours and drawing-rooms as no joint is then seen.

ON A PECULIAR VOLTAIC CONDITION OF IRON, FIRST NOTICED BY PROFESSOR SCHOENBEIN, OF BALE.

Sir,—The facts contained in the present communication, are not to be understood as laying claim to originality in their leading principles; some of the experiments, however, that I shall have occasion to describe, have never been made, or at any rate, I have never seen any account of them by any one else, and the whole are so extraordinary, and will, in my opinion, eventually throw such light on the rationale of Voltaic action, that I think you will not object to give them publicity through the medium of your Journal. In the *London and Edinburgh Philosophical Magazine*, vols. ix. and x., may be found the original papers of Professor Schoenbein and Dr. Farady. All the experiments there described, I have

attentively gone through, and I shall merely give here such an abstract of them as may be necessary to set the matter clearly before your readers.

Ex. 1.—When iron wire, $\frac{1}{12}$th of an inch in diameter, was immersed in nitric acid, specific gravity 1·379, it was attacked with violence; but when surrounded, or even touched in the acid by a piece of platina wire, action was instantly stopped. The platina was then removed, and the wire remained for any length of time in the acid without any action, and as bright as silver. If it was now taken out, wiped, and again immersed, violent action immediately took place for a moment, but it soon (generally) was again quiescent.

Ex. 2.—If, when the wire was in violent action, it was touched by a piece of platina, the effervescence instantly ceased, but again commenced when the platina was removed. Bringing the two metals a second time into contact effectually stopped the action. If the wire was in a very violent state of effervescence, it was not for some time protected by the platina.

Ex. 3.—If a wire made thus inactive by platina, was touched in the acid by a piece of zinc, or a common iron wire, it was thrown into action: but an iron wire having the smallest piece of platina attached to it, did not throw it into action, being itself inactive. If the platina was now slipped off, and either wire touched once with a common wire, both were instantly thrown into violent action.

Ex. 4.—When the acid was disturbed with an equal bulk of water, platina did not preserve iron wire from its action, even when coiled thickly round it; it appeared, indeed, rather to quicken the action. But though it did not preserve it under these circumstances, it did under others which I shall notice presently.

Ex. 5.—Half a wire, four inches long, was heated to dull redness, the blue tinge extended through three inches when the wire was cold, and these three inches were quite inactive in acid specific gravity 1·379, the other inch was active; when the heated end was made bright by filing, it was rendered active, showing the former inactivity to be owing to the superficial coating of oxide.

Ex. 6.—When a wire made indifferent to nitric acid by platina was immersed in the acid, and another common wire dipped into the same vessel, the latter was of course active; but when the wires were made to touch at their parts *above* the liquid, action was excited in the indifferent wire.

Ex. 7.—A common wire was made to touch an indifferent one, and both dipped into the acid, the *indifferent* one going in *first*. By this means, the common wire was made indifferent, not being in the slightest degree acted on by the acid; the second wire rendered indifferent a third, the third a fourth, and so on. This experiment succeeds best with wire that has been made indifferent by platina, but with care it will answer equally well with wire that has been made indifferent in the fire; the conditions appearing to be perfect contact, and gradual immersion. When these wires were taken out of the acid and wiped, they always returned to the active state, but were again made indifferent by repeating the process.

Ex. 8.—A wire, polished very bright, was protected by platina, and immersed in a solution of nitrate of copper, and nitric acid, which acted very strongly on common iron, copper being deposited on the metal: the protected wire *remained, however, bright*. After remaining a few seconds the platina was removed, the iron instantly became as common iron, but when the platina was allowed to remain in contact an hour or two, and then removed, the wire was left in the peculiar state, exhibiting the curious phenomena of a piece of polished iron being quite inactive in a solution of nitrate of copper and nitric acid. The wire thus inactive, on being touched by a piece of common wire was instantaneously rendered active, undergoing rapid solution, and becoming covered with a crust of copper.

Ex. 9.—A piece of iron was protected by a piece of platina, and immersed in nitric acid; the platina was then withdrawn, the iron remaining in the peculiar state. A piece of common iron was then bent into a fork, and slipped down the inactive wire into the acid, by which it was itself rendered inactive. Now if another piece of iron was made to touch the fork *before* being introduced into the acid, it was rendered itself inactive; but if it was first thrown into action, and then made to touch either end of the fork, it threw all the wires into action. This is rather different from the result obtained by Professor Schoenbein. He describes that end of the fork that was touched,

being *alone* thrown into action, the other remaining in the peculiar state as long as the first wire was kept in contact with the bend, but when that was removed both ends became active. The Professor's experiment was made with an oxydised wire. I found it difficult to reduce the fork to the peculiar state with such a wire, but when I accomplished it the phenomena were similar to those just described. I should much wish this experiment to be tried by others, as I am at a loss to understand whence this disaccordance should arise.

Ex. 10.—When an active wire was connected with one of the cups of a galvanometer, and a platina wire with the other cup, and both wires dipped into nitric acid, momentary action took place, and an electrical current was shown to pass from the iron to the platina through the fluid, the latter metal becoming positive, but the action soon ceased, the platina protecting the iron, though not in actual contact with it; when chemical action was stopped, the electrical current was stopped also.

Ex. 11.—When the iron wire was connected *first* with the galvanometer, and the circuit completed by putting it into the acid, the platina wire having been previously arranged, no action, either chemical or electrical, took place. The same was the case if a wire, having been previously made inactive, was substituted for the platina. Now when platina was used, the moment the circuit was closed, bubbles of gas made their appearance on the platina, and if an iron wire was used, having a small piece of platina foil or wire attached to it, the bubbles formed on all parts of the foil, but none made their appearance on the iron. If then the platina foil was removed, the bubbles made their appearance on the iron, which sometimes also went slightly into action.

Ex. 12.—When two cups were employed, being connected by a compound platina and iron wire, all the phenomena which took place in a single glass were observed, and the platina or inactive iron in one glass, exerted a protecting influence on the iron in the other, provided the communication was first made through the galvanometer; a touch from a common wire also threw the iron into action, producing a strong electrical current. The same was the case with three or four glasses connected by a compound wire.

Ex. 13.—When the acid was diluted, so as to have a specific gravity 1·204. platina, as was before observed, could not protect iron from its action; neither when connected with the galvanometer did it, if the iron was dipped in the acid first; but if it was first connected with the galvanometer, and then put into the acid, no action whatever took place in any length of time; on removing the platina, action sometimes took place; it always commenced when the inactive wire was once touched in the acid with an active wire, or with a piece of copper. The wire, thus made inactive, did not possess the power of rendering other wire inactive, but was always thrown into action itself. When a piece of common iron was substituted for the platina, whether it was connected with the galvanometer first or not, the wire in this case acted as platina to the second.

Ex. 14.—When two cups were employed, and connected by a bent piece of wire, and so arranged that the iron wire should be active, on removing the connecting wire, and taking a fresh piece, if it was dipped first into the cup containing the iron, and the other end brought into the platina cup, *that end was in the peculiar state*, and there was no passage for the electrical current, the needle of the galvanometer being quiescent; but when it was put into an active state the electrical current passed. Now here we have the iron made inactive *without any metallic communication with the platina*, and when inactive it is found incapable of conveying a current of Voltaic electricity; an inactive wire could not, in this experiment, be substituted for the platina. This latter most remarkable, and, as I believe, at present, inexplicable fact, has, as far as I know, never before been noticed, but that it is true, any one may in a few minutes convince himself. I have often left the whole arrangement undisturbed for hours, and still, at the end of that time, the end of the connecting wire in the platina cup has been *perfectly bright*, and the needle of the galvanometer stationary in its usual position; but on touching it once with a common wire, it has been thrown instantaneously into action, and then the electrical current has passed, the needle being strongly deflected; I am, at present, occupied in further researches, and I hope something

satisfactory in explanation of this dark subject will soon transpire.

I am, Sir,
Your obedient servant,

M.

Near Bath, March 15, 1837.

PRACTICAL REMARKS ON KEEPING BEES.

Sir,—Having been requested by some person desirous of keeping bees, to gi e, through the medium of the *Mechanics' Magazine*, my opinion as to the best method of managing these useful insects, I beg to solicit the favour of the following observations being inserted.

I have kept bees nearly twenty years, and practised various plans with a view to gain the greatest produce in honey and wax with the least trouble, but more particularly with a view to the preserving the lives of the bees, and feel confident that the story-fying system, which I believe Wildman practised, is the best. I tried for six or eight years the plan Mr. Nutt advocated, which, by-the-bye, is as old as any of the plans known, but without meeting with any thing like the success of the common cottage hive. A strong stock in the latter had produced me an early swarm and cast, the swarm producing in a good season upwards of forty pounds of honey, and the cast fifteen pounds, the stock being kept five or six years. The honey thus procured is always of good colour, and fit for sale; and when after six seasons the parent stock is destroyed, the honey, being dark, may be used to make meed, or sweeten wine with, a strong swarm being kept to supply its place. This plan requires the destruction of the bees, and is therefore censured as inhuman; but to me is not more so than destroying beavers and cats for their skins, or catching fish to manure the land with; the consumer never considering how produce is procured, and should, therefore, be considered the most culpable, if such acts are breaches of humanity. The hives I now prefer are flat, having wooden tops fixed on with wires. The inside should be twelve or thirteen inches clear, and about seven inches high, the top having a centre hole, and three or four others round it near the outside, each hole being two or three inches diameter, and fitted with nice bungs. If no swarms are wanted, a large glass, or small straw hive, may be put on the top about the end of March, or a small glass to each hole, previously pulling out the bungs, gently turning them round first, each glass having a bit of paper pasted on it, stating its weight when empty; such glasses being kept from the light, by an empty hive being placed over them. Every ten or twelve days they should be examined, and when filled may be removed, and others put on, as long as the season permits. If a stock is weak, a new swarm or a cast may be put on the top of it, and the entrance closed till eight or nine o'clock the following night. These stocks may be preserved seven or eight years, but should be kept in a house or shed; and when the winter begins, the bungs having been replaced, should be covered over with sacking or other warm articles. Glasses may be put on a swarm immediately after hiving them, removing them in three or four weeks, to enable the bees to procure enough for the winter. The boards above mentioned should be made of pine plank, half an inch thick. The bottom boards should be made of the same, one inch or one inch and a half thick, having a piece projecting for the bees to alight upon. By pursuing this plan, any number of stocks may be kept with but little trouble, and the bees saved; but the placing the glasses on empty hive on early, is essentially necessary.

I am, Sir,
Your obedient servant,
G. L. SMARTT.

Enfield, Feb. 10, 1837.

HINTS ON AEROSTATION.

Sir,—I have read your last week's Number, containing Sir George Cayley's luminous communication on aerostation, and am glad to see the subject so generally taken up as it is by men of science, who have paid attention to the subject. My time does not permit me to remark upon it further, than that it appears to me to contain many remarks that must be highly useful in aiding the future efforts of aeronauts, because I consider that (like Hudibras's horse), it wants but *one spur* to move it into action, and hope most of his suggestions may he adopted by a company, to which I wish every success, as the science of France and the

ingenuity of America are at the present moment busily employed to bring aerostation to perfection; but it is to Britain alone (the hot-bed of speculation), that the world must look for a company capable of providing aerial machines of such vast magnitude—if such, indeed, are necessary – as those alluded to by Sir George Cayley.

Nevertheless—(and I have marked the progress of balloons from the attempts of Pilatre de Rozier and Montgolfier, &c., to the latest effort of Mr. Green in his stupendous one, many of which I witnessed; among them the perilous but useless exhibition of Garnerin in his parachute),—I still remain of the same opinion that I have before expressed in No. 678 (August 6); namely,—First, that the rotund shape is inappropriate for guidance, and can be remedied; secondly, that any thing round requires great force to propel it, as a cannon-ball, a cricket-ball, &c.; and, thirdly, that all essays to improve aerostation should be made upon the smallest scale possible (that is to say, sufficient to carry up one or two persons, and no more), as magnitude would naturally follow success.

I remain, Sir, yours, &c.

OMRI.

March 8, 1837.

BERLIN IRON SNUFF-BOXES.

Sir,—Perhaps some of your correspondents can explain why it so frequently happens that the English mechanic, while he displays the most laudable industry and ingenuity in the strict pursuit of his trade, still confines his attention almost exclusively to a limited routine of operation, and treats with neglect, perhaps with contempt, any suggestion not in strict accordance with his established notions of the great and useful.

The above reflection, which I have had frequent occasion to make, was forcibly impressed on my mind by a recent visit at the shop of Inderwick, in Prince's-street, Soho-square. I was there shown some very pretty specimens of snuff-boxes, made of *cast iron*, and manufactured at *Berlin*, of a very tasteful design, and only three ounces in weight.

Again, allow me to ask—why is it only the *foreign artisan*, who seems capable of *condescending* to such *minor* novelties, frequently a source of no *minor* profit? I hope the above observations may induce some one better acquainted with the foundry than I am, to call and look at the boxes I allude to; for I really cannot help thinking (and he, perhaps, will there agree with me) that an article of very general use, as the snuff-box certainly is, if it were got up on this Berlin style, and not too expensively, might be rendered the source of a very satisfactory profit.

At all events the experiment is a harmless one, nor can he have any reason to say with Hudibras,

"Behold! what perils do environ,
The man who meddles with cold* iron."

I am, Sir,

Your obedient servant,

J. C.

REMARKS ON MR. BADDELEY'S STATIONARY FIRE-ENGINE.

Sir,—I an extremely glad to find that Mr. Baddeley has had the penetration to discover the great superiority which a rotary motion, such as I proposed on page 9 of your last volume, has over the reciprocating one, in use at the present time for fire-engines. There is one objection, however, which I conceive would, in a great measure, destroy the practicability of Mr. Baddeley's plan; and that is (if it is to be stationary, as he suggests), the great number which would be required in London, to keep it at all free from fires. There would need to be about one in every street throughout the place, otherwise the friction of the water passing through so great a length of pipe or hose, if the latter be used, would form a serious inconvenience; and the expense would operate against having so large a number of engines, as Mr. Baddeley's plan would appear to require.

I cannot help noticing, however, the very compact form in which it has been arranged. Mr. B. is quite correct when he says, that the form I proposed was deficient in stability; but as I contemplated a moveable affair, I did not at the time see how it could be done otherwise. Indeed, I did not submit it as a practical thing, but merely as a hint to the numerous

* Or cast-iron, if you will.

correspondents in your Magazine upon the subject of fire-engines, as to the advantages to be derived by substituting a continuous rotary motion, for an alternating or reciprocating one; and also by using horse-power, whenever it could be conveniently obtained, instead of manual labour.

Mr. Baddeley is, perhaps, not aware that in the city of Washington there are in several different places "running pumps," which are, in fact, fountains in the shape of pumps; from the iron spouts of which water is continually flowing, day and night, not in a gentle stream, but so forcibly as to make it extremely difficult to hold any thing in its way, without having it driven from your hand, and furnished with a screw, so that the hose can be attached instantly, and a stream of water two-and-half inches in diameter thrown up considerably higher than the houses; but that, notwithstanding this, they prefer the engine on four wheels, worked by hand, to having a great length of hose, although, in the latter case, no labour is required in pumping. It is this fact that makes me fearful that Mr. Baddeley's plan will not answer his expectations to the full extent.

I am, Sir,
Your obedient servant,
F. P.

Westminster, March 21, 1837.

MESSRS. MACKINNON AND BAINES'S PATENT LAW AMENDMENT BILL.

Whenever, by any alteration in the law, a number of new and lucrative offices are to be created, a *prima facie* case of suspicion is presented that the case is a "job," and it becomes the duty of a public journalist to examine the proposed measure, to see whether such creation is necessary, and whether the expense attending it will be productive of commensurate benefit. We are bound the more narrowly to scrutinize such a case in these days, when commissionerships are as plentiful as blackberries, and when every hour furnishes its apt exemplification of this new and admirable system of governing a country without patronage. Let us then see how stands the matter in the present instance.

The first and fourth sections of this Patent Law Amendment Bill, proposes to vest in his Majesty, or rather in his Ministers, the appointment of six new officers for the administration of the law in relation to patents for inventions; namely, a Chief Commissioner, two Commissioners, a Secretary, and two Registrars. The Commissioners are further to have the appointment of various inferior officers. The salaries to be given to these various officers are left to be filled up in Committee, should the bill be allowed to proceed to that stage; but whatever may be their amounts, the offices, unless the process of obtaining patents be greatly complicated instead of simplified, will be nearly sinecures. Mr. Mackinnon, in his speech on the motion for leave to bring in a Bill,* lays great stress upon its "removing a burden from the shoulders of the Attorney and Solicitor-General." This burden of business, we will venture to assert, has not occupied on an average above an hour in a week of the personal attention of these legal officers. Not one patent in twenty is opposed, and in nine out of ten cases of opposition, the matter is decided in half an hour; and unless there be opposition, the whole proceeding of passing a patent is matter of form, and the "burden" is borne by the Attorney and Solicitor-Generals' *clerks*. All the personal duties these Crown-officers perform, being to affix one or other of them his name to the Report and to the Bill. Such, then, is the extent of official duty to be performed by the whole machinery of three Commissioners, two Registrars, and a Secretary. Should these six offices ever be created, they would answer exceedingly well as "Chelsea-quarters" for veteran scientific gentlemen, instead of pensioning them from the civil list; there would be nothing to interrupt their "*otium cum dignitate*," but now and then a discussion upon some applicant's invention; something very near akin to those at the Society of Arts in the Adelphi, of a Thursday evening, where smatterers in science and amateur mechanics are the chief orators. One Commissioner, we should imagine, would be amply sufficient to transact the whole of the proposed practice in Letters Patent.

The ninth clause sets forth the pro-

* Which has been published as a pamphlet with a copy of the Bill, by Roake and Varty, Strand.

ceedings to be adopted for obtaining letters patent, and inasmuch as it shortens the process, it is an improvement upon the old law. A petition to the King, accompanied by an *affidavit* in support thereof, is to be lodged with the Commissioners, who are to advertise it in the *London Gazette*, and appoint a day for hearing objections; if, upon hearing all parties, the Commissioners think the prayer of the petition ought to be granted, they are to make out a bill or draft of the patent, and transmit it to the Secretary of State, for the King's sign-manual; the Commissioners are then to make out the letters patent, and send them, with the draft or bill, to the Lord Chancellor, who is to affix the great seal. Here we cannot but pause to admire the loyalty and deep concern of Mr. Mackinnon, for the preservation of the royal prerogative, as well as his praiseworthy dread of being suspected of the slightest taint of Radicalism. "With regard," he says, "to the delay in obtaining the King's sign-manual to the warrant, and afterwards to the patent itself, I confess, in these Radical times, I feel some difficulty and hesitation that his Majesty's signature should be dispensed with in the patent."

Notwithstanding Mr. Mackinnon's protestations of loyalty, we hardly know how to reconcile with it the actual want of consideration for his Majesty's ease, which his method of proceeding displays. What he considers a burthen in the case of Mr. Attorney and Mr. Solicitor General (two signatures in the course of a patent), and wishes to remove from their shoulders, he feels "difficulty and hesitation" in taking off the shoulders of his Majesty! Neither his Majesty nor his Secretary of State are authorised to receive any fee by the proposed Bill, (as they do at present); since, therefore, they are to have no pay, we should therefore rather think they would prefer being without the work,—and to the parties most concerned, patentees, this would be a great simplification and saving of time.

As the Commissioners are not empowered to guarantee to a patentee the originality of his invention, we cannot see any good that can result from their having a discretion to refuse compliance with a petition for a patent, except in cases where a like invention has been already patented but not specified; and they can only come to a knowledge of such being the case by the opposition of the prior patentee. Where he does not think it worth his while to oppose, his right having been already secured against all after comers, a second applicant may also have his patent for a same subject, and will not know his loss until his forerunner specifies. This can only be avoided by every applicant describing his invention at first to the Commissioners, for which there is no provision in the Bill; otherwise the granting of the patent is left as it was, a mere matter of form, except when a question of priority of title is raised by the opposition of another party.

The provision, that the patent shall date from the presentation, of the petition instead of from the sealing or completion of the patent, as heretofore, is an improvement; but there can be no safety where a monopoly is granted on a bare title—such, for instance, as that one of every-day occurrence, "Certain improvements in Steam-engines." The evil which this enactment is intended to remedy is this:—a person applies for a patent, designating it with the vague title we have just instanced, but, perhaps, not being well provided with money, or unaware of his danger, he carries it through the various stages slowly, and at his convenience, making experiments the while; and in two or three months after the commencement, his patent is sealed, which is the concluding step, and from which the patent dates. A second party, either honestly or surreptitiously, discovers the same thing as the first supposed party, and subsequently commences or petitions for his patent, and passing it through the various offices expeditiously, gets it sealed *before* the first applicant, by which means a subsequent inventor obtains what by right belongs to the first inventor. The proposed provision, however, does not remedy the evil; both the parties instanced would, after obtaining their patents, remain in the dark as to their respective rights being in danger, until one of them specifies and the other becomes aware of his having a rival to cope with; and when, although he be the first inventor, being but the subsequent patentee, he must sit quietly down under his loss, both of invention and money expended for patent, or enter into long, expensive, and doubtful litigation with his opponent. The reader will thus perceive that the evil results from the granting of patents upon titles

which can be afterwards made to apply to a variety of inventions—"bird-lime" titles, as an eminent counsel very fitly designated them in a late patent trial—and from so long a time being allowed to elapse before the description of the invention for which the patent is granted is enrolled. Either a general description, to which the subsequent specification should bear reference, should be lodged with the petition, or the specification should be filed at once: the former, perhaps, would be the preferable mode.

The most material point on which it is proposed to legislate, relates to the expense of granting Letters Patent, which Mr. Mackinnon thinks is at present "*rather* too considerable." Why one farthing more should be charged than is sufficient to defray the *necessary* expenses of the various offices, it would, perhaps, be difficult to show. Either a person has a just right to what he invents, which ought to be protected at the smallest possible expense, on condition of his surrendering a part of that right for the good of society, or he has no such right; in which case, it should not be conceded to him at any expense.

Our readers will be surprised when we state, that although this Bill professes to reduce the expense, it will materially increase it! The following is a tabular comparative view of the actual fees paid to the various offices for patents at present, and those proposed to be paid by the new Bill: exclusive, in both cases, of the specification:—

	Amount of present Fees payable at various Offices.			Fees required to be Paid by proposed Bill, exclusive of those which Commissioners may hereafter Appoint.
	£	s.	d.	£
Patent for the United Kingdom ..	271	6	1	205
United Kingdom and Colonies....	275	11	1	255
England alone.....	94	17	0	85
Scotland alone.....	64	5	1	55
Ireland alone.....	112	4	0	85
England and Scotland	159	2	1	135
England and Ireland	207	1	0	165
Scotland and Ireland	176	9	1	135
England and Colonies	99	2	0	140
Colonies alone				55

*** Patents for the Colonies under the present practice are always attached to the English patent;—should the Colonies not have been applied for in the petition of the English patent, the right can only be obtained by getting another patent which shall include the Colonies;—by courtesy, the various officers have allowed this to pass for half the usual fees. We believe no instance has occurred in which the Colonies have been attached to Scotch or Irish patents.

At first sight it may seem that the *new* fees are generally less than the *old*, and so they would be, if there were nothing more to be paid than this table exhibits; but if the reader will please to turn to the 25th section of the proposed Bill (see *Mechanics' Magazine*, No. 709, p. 465), he will there find it provided, that the "Commissioners shall from time to time, as it shall appear to them expedient, make and issue such general orders as they shall think fit, for carring the provisions of this Act into execution, and *also for regulating and affixing the fees to be hereafter paid and payable at the offices of the Lord High Chancellor, and of his Majesty's Principal Secretary of State respectively, as well as the other fees to be paid and payable at the office of the said Commissioners, appointed under and by virtue of this Act, and which are not set forth in the schedule hereto annexed, in respect of the several matters and things to be performed at the said offices respectively.* Provided always, no general order of the said Commissioners shall operate or take effect, until the same shall have received the sanction and assent of the Lord High Chancellor."

It is always a dangerous trust to repose in any man or set of men the power of remunerating themselves, according to

their own estimate of their services; and although, in the present case, there is the safety-valve of the sanction of the Lord Chancellor, we imagine that it would not be over heavily weighted. Besides, the sums mentioned as to be paid in the above table, the fees to be paid to the Secretary of State for the sign-manual, the Lord Chancellor for the great seal, and the Commissioners to themselves and their officers are yet to be appointed, and added to the scheduled amounts! There can be but little doubt, but that the preponderance of expense under the Commsssionership, would greatly, exceed the present. The reader will bear in mind that we have in the view here taken of the subject, both as respects the present and proposed practice, altogether excluded, as well all agency charges, as the cost of the specification, which depends on the circumstances of the case.

But with respect to the scheduled fees, to what are they to be applied? Taking the average of patents issued for the three kingdoms, as given in an Appendix to Mr. Mackinnon's pamphlet, viz. 241; and taking the price as fixed in the Bill, for a patent for the United Kingdom (which is much below the cost proposed when disjointed), an annual amount would be produced of about 50,000*l*. Under the present practice we acknowledge a larger sum than this is taken from the patentees' pockets, but the greater part of it is distributed amongst a large number of state officers and clerks. Mr. Mackinnon proposes to take it away from all these parties, and that it shall be paid into the Bank of England to the credit of the Commissioners, and to be subject to their order for the payment of compensation, salaries, and expenses, and the surplus to the Consolidated Fund. The first year or two's profits would certainly be absorbed in paying the compensations to be given under the Bill, to the officers who would lose by its passing into a law. A large amount would, however, soon afterwards become available, and which ought certainly to be applied for the benefit of those who contribute to it. In Belgium, a similar fund is applied to the granting of rewards for the encouragement of the arts, and of the national manufactures; we merely mention this as a hint, should the Bill be committed. There is one point to which such a fund ought, in justice to those from whose pockets it is drawn, to be applied—namely, the publication of the specifications of all the patents which have been granted, from the earliest period to the present time. Inventors would then know what had been patented before; and such cases as that of Wells's patent for purifying sea water (see *Mechanics' Magazine*, No. 658, p. 488), where the same thing had been patented several times, would not occur. Lord Lyndhurst did not know the difficulties in the way, and the expenses, when he talked of "patentees *choosing* to shut their eyes, when they might have gone to the patent-office and seen the specifications at once."

There is one clause in the Bill which has our hearty concurrence—that which prohibits an officer, connected with the proposed Commission acting as an agent in the passing of patents, under a penalty of 500*l*.

In conclusion, we cannot wonder at the defects of this Bill, when it bears on the face of it such instances of an ignorance in its authors of the present practice—as stating that an *affidavit* is at present made in support of the petition, a declaration having been substituted two years ago—the heavy duties of the Attorney and Solicitor-General, which we have already commented upon; and Mr. Mackinnon in his speech talking of the King's signature to the patent itself, when no such signature is ever appended—"Commends," in full-faced black letter, being the only signature we can find upon that document, the which, if it be an autograph, is better written than any others that have ever come under our notice.

The license for a year for the protection of patterns, is intended to prevent the piracy so much complained of by various artists and manufacturers, in their evidence given before the Commons' Committee on arts and manufactures, of which we gave an abtract in our last volume. The present provision, if enacted, will, no doubt, in a measure prevent the evil, but we have not space to enter into the question. We may, however, observe, that the license ought in some cases to be renewable.

In the Bill altogether, there may perhaps be a sufficiency of good points to warrant its committal; but in Committee it must be entirely remodelled, otherwise it will not effect what its introducer proposes—viz. to "promote the welfare of ingenious

men, by securing to them the benefit of their inventions."

NEW AMERICAN PATENT LAW.

There seems at the present time to be a general move in the world of Patentees. Our own legislators have hardly passed one bill on the subject, when they are called upon to pass another, and patent specimens of legislation they both appear likely to be. On these I shall not presume to offer any remarks, as I perceive they are to be commented on in the *Mechanics' Magazine* by a hand which is certain to do them justice; but there is another branch of the same extensive subject, on which I must ask permission to occupy your space with a few observations, as I have long waited in vain to see the theme taken up by some more competent correspondent.

In No. 673 of the *Mechanics' Magazine*, (published in July, 1836.) appears a Report of a Select Committee of the American Congress, appointed to take into consideration the Law of Patents. This report presents, in some points of view, a striking similarity to those of some late Committees of our own House of Commons, and it shows a dissimilarity equally striking. The resemblance consists in this, that the Committee sometimes contradicts in one paragraph that which it asserts in another. While we are assured in one part of the report that "a considerable portion of all the patents granted, are worthless and void;" that "the country is flooded with monopolies of even the most common machinery and long known improvements in the arts;" that the frauds committed by taking out new patents of inventions already patented by their real inventors, are already extensive and serious; and that this branch of roguery is, in fact, become a "regular business;" we are told in another, that if all this cheating be put a stop to, the number of patents will only be "*somewhat* diminished," and the "several thousands of interesting and valuable models now preserved" in the office, (but since destroyed by fire,) are spoken of in the mass, as if they were gems beyond price, the view of which would "tend not a little to elevate the national character." In the same page we learn that "patents even for new and meritorious inventions are so much depreciated in general estimation, that they are but of little value to the patentee;" and yet that "several hundred thousand dollars, it is estimated, are paid annually" for permission to make use of pirated patents; and that in the first three months of 1836, the very year in which the bill is called for on the ground of this new depreciation, more has been taken out than in the whole ten years from 1790 to 1800, in which they were held in so much higher esteem, and found of so much more value.

So much for the resemblance between transatlantic Committees and our own. The point of unlikeness is a still more glaring one. The members of our House of Commons, industrious as they have lately been in that line, have scarcely, after all, displayed so much eagerness to run down and depreciate the talents of their countrymen, as the members of the American Congress to puff up and exalt the merits of theirs. The subject of the surpassing ingenuity of the Americans, and their vast superiority to any nation whatever on this side of the Atlantic, is one that they are constantly recurring to, and of which they never seem to grow weary. To any one but an American, their language of panegyric seems warm enough at first, when speaking of the rise of American manufactures, they say that "a more rapid advancement in the arts, and a more astonishing development of human ingenuity, have never taken place in any other age or country." But compared to what follows this, is damning with faint praise. "What mechanism or manufacture," they soon after exclaim in a burst of enthusiastic admiration of themselves, "has, for the last twenty years, been brought across the Atlantic, that has not, on being returned, borne the distinguished marks of the superior ingenuity of the American mechanists? Formerly, we borrowed and copied much that was valuable from Europe. Now, Europe is borrowing and copying with no little advantage from us, and she must not be too much surprised, if she shall soon find a formidable balance against her." "It has been justly remarked," they afterwards observe, "that we can go into no mechanic shop—into no manufactory of any description, upon no farm or plantation, or travel a mile on *our* railroads, or in *our* steam-boats, without seeing the evidence of *our* originality,

(in railroads?) and witnessing the fruits of *our* ingenuity and enterprise." It might be remarked with equal justice, that we cannot take up an American book, or read an American document, even such a one as the present, an official report, which ought, of all things, to be grave and unpretending, without witnessing some ridiculous ebullition of American vanity, and American self-conceit. On the principle that of two evils, the least should be chosen, we, in England, ought certainly rather to wish that our legislators should continue, as they now do, to manifest an undue disregard of native talent, which can only ultimately tend to the discredit of themselves, than that by taking the opposite course, and plastering us with panegyric, (it matters little when coming from such a source, whether well or ill deserved,) they should render both themselves and the nation ridiculous. The good old proverb so familiar here, has certainly, some how or other, not found its way across the Atlantic, "Self-praise is no commendation."

All this, it may be said, is merely a question of opinion and of taste. This report on the law of patents, however, presents a feature to which objections of more serious consequence will apply. Those who have entertained a high notion of the liberality and fair spirit of the citizens and government of the United States, will learn with some surprise, on the authority of this Committee of Congress, that an act which was passed in 1790, extending to aliens and to citizens the same privilege of having their property in discoveries and inventions protected, was three years after repealed, and another act passed, "authorising patents to citizens of the United States *only*;" or, in other words, making it legal to plunder foreigners of the fruits of invention and discovery. For three-and-forty years afterwards, this system of alienating the property of aliens, was allowed, it seems, to go on, while, during that time, the citizens of the United States were taking out innumerable patents in foreign countries, whose institutions did not happen to legalize theft. At length, in 1836, comes this Committee—this glaring instance of national injustice stares the members in the face; and mark the tender language in which they speak of it, and the very adequate remedy they recommend to be applied. "Heretofore," they observe, "aliens not resident in this country (or who are resident, have not made oath of their intention to become American citizens) have not been admitted to the privileges of our patent laws. But *as American citizens are allowed to take out patents in England*, and in other countries, a principle of reciprocity *would seem to require* (it would indeed) that foreigners should have similar privileges here." So far so good—nothing can be more plain; but what follows? "ON PAYING A SIMILAR DUTY OR AMOUNT OF FEES THAT IS EXACTED OF OUR CITIZENS ABROAD!!" The fallacy here is so gross, that it is impossible to suppose that the error was committed in good faith. The "meanest capacity" could scarcely be led to believe that a principle of reciprocity would ever require any such thing. Suppose it had been a law in America, that no foreigner should be allowed to purchase land, and it were proposed to amend it, what would be said of the intellects of a person who should remark that the principle of reciprocity would seem to require that land in America should be sold to a British citizen at the same rate per acre that an American citizen could purchase land in Great Britain. Yet this is the identical notion on which this Committee recommends a law to be framed, and on which a law has been framed, which passed the scrutiny and gained the sanction of the House of Representatives and the Senate, and was finally "approved" on July 4th, 1836, by President Jackson. The 9th section of it runs thus (as given in No. 697, of the *Mechanics' Magazine*, December 17th, 1836):—

"And be it further enacted, That before any application for a patent shall be considered by the Commissioners as aforesaid, the applicant shall pay into the Treasury of the United States, or into the Patent-office, or into any of the deposit banks to the credit of the Treasury, *if he be a citizen of the United States*, or an alien, and shall have been a resident in the United States for one year next preceding, and shall have made oath of his intention to become a citizen thereof, the sum of 30 *dollars*; if a *subject of the King of Great Britain*, the sum of 500 *dollars*; and all other persons the sum of 300 dollars, &c. &c."

As it seems absolutely impossible that a nation so clear-sighted as the Ameri-

cans are usually considered, should really be so stone-blind in one particular, as to regard an enactment like this as just, the inference is, I fear, unavoidable,—that they are indifferent what injustice they commit so long as the injury falls on others, and some advantage is derived to themselves. Had the passage, in the report of the Committee, expressed the real sentiments of its authors, it would certainly have run thus:—"Heretofore we have netted no small gain by trespassing on the generosity of foreign nations, who have allowed us to take out patents in their dominions, while we have proclaimed all the inventions they could produce a free prize to the free citizens of America. But as there is reason to think that the patience, if even the most forbearing, would inevitably be exhausted by a longer continuance of this piratical system in all its naked deformity, a principle of self-interest would seem to require that we should relinquish, of ourselves, some portion of its sweets, lest the retaliation which we have provoked should deprive us of the whole. Though thus compelled, however, to give up robbing on the highway, we have a scheme which may properly be deemed by foreign nations too contemptible for active resentment, by which we may for some years longer be able to carry on the war against aliens, in the way of picking pockets."

This language may be thought strong, but it is certainly not too strong for the occasion. This act, and this clause of the act, have evidently been the subject of sufficient consideration; for the price of applying for a patent has been limited from forty dollars, as originally proposed, to thirty, as it now stands, for an American citizen; while subjects of the King of Great Britain have still been considered but too fortunate to be admitted to the "privilege" of protecting the most sacred of all property, for somewhat more than sixteen times the sum. It is clear that the act of injustice has been done deliberately, and with malice aforethought. It was intended, I suppose, to throw dust in the eyes of the people of England; to set up a reputation for "liberality" among patentees on this side the Atlantic, on the ground of voluntarily withdrawing an obnoxious law; but if this be really the case, it is only adding fresh injury to the old one, by showing contempt for our understandings. It is not trying, in fact, to throw dust in our eyes, but to throw blocks of granite.

I know, Mr. Editor, that your columns will be open to both sides, if the appearance of this letter in your pages, which are extensively circulated in America, should lead any American citizen, who thinks the new Patent-law susceptible of defence, to take up the cudgels in its favour. I hope, however, better things from our brethren over the water. I hope that when they are fully aware of the act of scandalous injustice their Legislature has been committing, their indignation will, as it ought to do, for they are involved in the dishonour, far surpass any that an Englishman can feel on the subject. If such be the case, the iniquitous law will, of course, be swept from the statute-book in less time than it takes a Kentuckian to dash through a churchyard of milestones.

I am, Sir, yours, &c.

A Subject of the King of Great Britain.

March 21, 1837.

ASTRONOMICAL RULES WANTED.

Sir,—Will you permit a constant reader of your useful and widely-circulating Magazine to put a question or two to some of your scientific friends, the solution of which will, I have no doubt, be acceptable to many of your astronomical readers, whose knowledge, like my own, is more practical than theoretic. It is universally acknowledged, that the first object of the practical astronomer is the obtaining the correct time. Indeed, in almost every observation this is indispensable. Hence, many different means of obtaining it have been proposed, and among others, one was some time ago published in the "Astronomical Society's Memoirs," founded on the appearance of two stars in the same vertical line. I am accustomed to travel with a small transit instrument, which, however, I can seldom use, owing to the difficulty of getting it accurately in the meridian in any reasonable time. But I find that with this instrument, the time when a star at some distance from the pole star is passing under it, or, in other words, is in the same vertical line, may be observed in a few minutes only. It is evident that this time must differ from that at which the lower star passes the

meridian, in proportion to the pole star's distance from the meridian at that instant; and the paper in the Memoirs above-mentioned gives a formula by which that may be found. But, unfortunately for me, I do not understand formulas; and what I have now to request is, that some of your scientific readers who do, would have the kindness to put it in the shape of a rule, such as we find in books of navigation, so that a plain sailor like myself might understand it; or what would be still better, would give us at length the answer to the following example:—Feb. 1st, in lat. 51° 30', γ Draconis was observed to be directly under, or in the same vertical line with Polaris, required the time.

Again, can any of your readers inform me if there is any astronomical work which gives rules for calculating the librations of the moon? Our excellent "Nautical Ephemeris," it is true, gives us the time when the librations arrive at a maximum, but, I must own, I do not see the utility of this, or how I am to find from it the situation of any spot at any particular time; yet this, I suppose, is what is most generally required. For example:—The latitude and longitude of the spot, Plato, in a mean state of libration, is 9° 12′ E. and 51° 14′ N., respectively, and I can from them lay down its exact apparent place on the lunar disc. But what will be its position on the 20th of next month, for instance, at the time of the total eclipse? If there are any rules for finding this, I shall be much obliged by being informed where they are to be found.

I am, Sir,
Your very obedient servant,
NAUTICUS.

Exeter, Feb. 9, 1837.

REPLY TO MR. THORNE'S GEOLOGICAL ARGUMENTS IN FAVOUR OF THE ELECTRICAL THEORY.

Sir,—It appears that Mr. Mackintosh has got one staunch supporter in the person of Mr. Thorne; he avows himself to be a perfect believer to what I consider to be the most extravagant part of the Electrical Theory of the Universe; namely, the story of the five moons, &c. This is not altogether to be wondered at, for let a system be ever so absurd, it will always find some supporters.

Notwithstanding the rigid mathematical demonstration given by Kinclaven (No. 680), showing the ridiculous absurdity of our earth having been at one period attended by five moons (and which demonstration Mr. Mackintosh wisely forbore to grapple with), still Mr. Thorne wishes to revive this most foolish part of the electrical theory. "We see (he says, No. 707,) in various parts of the world, extensive chains of mountains of great altitude, corresponding in number to the satellites which this theory supposes to have existed." (That chain of mountains in Africa which extend between Abyssinia and Monomatapa, called the Mountains of the Moon, is undoubtedly one of the chain of mountains Mr. Thorne alludes to.) "Why may not these several chains of mountains have been the places of deposit of particular satellites," &c. Well, Mr. Editor, with your permission I shall endeavour to shew some of the consequences that would result to our planet in the event of a collision with the moon. If that event should take place, it is certain that the poor moon would be smashed in pieces after the collision takes place; we shall first suppose that the whole matter in the moon is equally scattered over the whole surface of our globe. Then to determine how far the present surface of our planet would be buried under that covering produced by the matter in the moon.

By the best authority, the quantity of matter in the moon is to that in the earth, as 1 to 71, or the quantity of matter in both is to that in the earth, as 72 to 71; also, let the radius of the earth be 3971 (a) miles, and x equal to the depth of the external crust. Then, by similar solids, we have $71 : 72 :: a^3 : (a+x)^3$, or $71\frac{1}{4} : 72\frac{1}{4} :: a : a+x$, or $71\frac{1}{4} : 72\frac{1}{4} - 71\frac{1}{4} :: a : x$, or $4{\cdot}140818 : {\cdot}01935 :: 3971 : x$. Hence,

$$x = \frac{{\cdot}01935 \times 3971}{4{\cdot}140818} = 18{\cdot}5564 \text{ miles} =$$

18 miles 979 yards. That is, the whole of the present surface of the globe would be buried 18 miles 979 yards by the matter contained in the moon; or the top of the highest mountain on the earth would have a covering of more than 13½ miles.

I do not know whether Mr. Mackintosh or his supporter, Joshua, have any idea of the exact time when this terrible

catastrophe is to happen. If they do know, and that the period is not very remote, I would advise them to say nothing about it; for it would play the very deuce in railway speculations.

I know it may be urged, that no positive reason could be assigned why the whole matter in the moon should be equally scattered over the whole surface of the globe. Well, we may suppose the moon to come bump upon the centre of Africa, and that its whole matter is equally scattered over only that quarter of the globe. It would raise the surface of Africa more than 200 miles above its present level, and then the London cockneys might have a view of the northern parts of Africa from the top of St. Paul's! But I am somewhat afraid that St. Paul's and every other building on the earth would be hurled to the ground by the terrible shock.

Again, it may be stated, that the near approach of the moon to the earth would produce a second deluge before the collision took effect; then, of course, we would be all drowned before the shock took place. But, Mr. Editor, to enter fully upon all the probable calamities that would take place from such an event, would more than fill a volume.

I am, Mr. Editor,
Your obedient servant,
A COUNTRY TEACHER.

March 14, 1837.

EFFECT OF HIGHLY-HEATED METALS ON THE GENERATION OF STEAM—COLOURED WATER.

Sir,—My attention having been drawn to the very curious inquiry, which is detailed by Mr. Tomlinson, of Salisbury, in your Number of January 28th, I would beg to make a few remarks thereon.

It appears from the results of Mr. T.'s experiments, as also from his extracts from Pouillet, Baudremont, and Laurent, that a globule of water, when contained in a metallic vessel, evaporates in a shorter time, if the vessel be at or about 212 degrees, than if it have a higher temperature. This is very remarkable, and far removed from the common ideas on the subject; but I cannot assent to Mr. T.'s explanation, so far as regards the existence of a stratum or bed of steam between the vessel and the water.

We all know that the specific gravity of steam is less than that of air, and infinitely less than that of water. On what principle, then, can a portion of steam exist *beneath* the water? Let us take the analogy of any fluid whatever, and see how far it will bear out the objection.

If we have a vessel of water in process of heating over a common fire, the first formation of steam takes place at the bottom. This *ascends* to a higher stratum of water, and is then condensed and imparts its caloric to the watery particles with which it is immediately surrounded. It is this which so rapidly heats water, for the *conducting* power of water is exceedingly limited.

We constantly observe that the rapidity with which the bubbles of vapour rise to the surface is proportionate to the heat of the water. Now, let us apply this to the case of the heated crucible. Mr. Tomlinson supposes the existence of a stratum of steam under the globule of water, which retards the transmission of heat from the metal to the water; but why should not the law of specific gravity remain in force at high temperature? Why should not the steam—its expansive tendency being still more increased by its high tension—why should it not have the power of darting upwards through the watery globule, in order to gain the level of a lighter atmosphere? We must recollect that the steam is formed from the globule itself, at the lower part of it; and ought, if it exist at all, to ascend to the upper part of the globule, just as the steam-bubbles in a common kettle of ter do.

I feel more inclined, of the two opinions, to choose that which attributes the slow evaporation of the globules of water to the rapid passage of heat through it. Extraordinary as such a hypothesis may at first appear, yet we have analogies in physical science which aid such a conception.

A pane of glass, broken by a pistol bullet, is not so much shattered as when broken by a stone moving with perhaps not one-tenth the velocity. If a card be balanced horizontally on the end of the finger, and a shilling placed on it, and if the card be struck sharply on the edge, it will slide away from under the shilling, leaving the latter on the finger; but if it

be struck more softly, both card and shilling will fall.*

It would appear that *transparency* consists in a perfect facility in the progress of light, through the pores of any substance. Now, if we suppose that heat is *material*, we may conjecture that the calorific tension, when the vessel is highly heated, is sufficient to overcome the reluctant conducting power of water, and that it darts through the latter by virtue of the velocity acquired by such tension.

I do not wish to give this opinion the air of a theory, but there is one remark of M. Laurent's, quoted by Mr. Tomlinson, which I should much wish to see the basis of a series of experiments; he says that when he used coloured water instead of transparent, the water evaporated much more rapidly.

Now, to those readers of your excellent Journal who have facilities of making such experiments, I would beg to observe, that it would be very desirable to know whether a given quantity of water, at a given temperature, evaporates in a shorter time when *coloured* or *black*, than when transparent.

Black we know to result from the absorption of all light and colours from that of some of the rays. Now should we find that blackened water absorbs more heat, or absorbs heat more quickly, than transparent water, it would permit some evidence of the analogy between light and heat, and would also assist us in determining whether the rays of heat from an excessively heated vessel do really pass through the water too rapidly to impart much of their influence to it during the passage.

Professor Leslie made some very accurate experiments on the comparative absorptive power of different substances for heat, but I am not aware whether they extended to water differently coloured.

Whether metals and water become, at a high temperature, electrically excited with the same kind of electricity, and so repel each other, we cannot at present say; but should such turn out to be the fact, it might furnish us with a reason why the globules of water appear not to be in contact with the heated metal: but be this as it may, it would assist us in the solution of this interesting question, if we could determine whether the same apparent repulsion exists between the metal and *coloured* or *blackened* water, as between it and pure colourless water.

At all events, I can scarcely subscribe to Mr. Tomlinson's opinion, that a bed of *steam* exists between the water and the globule.

Your obedient servant,

D.

* The acknowledgment of such a principle is conveyed in the story of the Turkish headsman, who was so dexterous in the use of his scymetar, that he could cut through the neck of a culprit *without disturbing the head*, when he moved his scymetar with great swiftness.

LIST OF IRISH PATENTS, GRANTED IN THE MONTH OF FEBRUARY, 1837.

Michael Linning, of Hill-street, Edinburgh, one of the Clerks of his Majesty's Signet in Scotland, for a certain improved method of operating for the purpose of converting peat-moss and peat-turf or bog into fuel, and obtaining from it tar-gas and certain other substances or matter. Dated Feb. 25.

William Brindley, of Caroline-street, Birmingham, for improvements in the manufacturing of tea-trays and japanned ware, and in the board or material used therein. Feb. 25.

George Richard Elkington, of Birmingham, for improvements in preparing and applying India-rubber, caoutchouc, to fabrics. Feb. 25.

NOTES AND NOTICES.

We are not disposed to question the date of the speculations sent us by "A Constant Reader," and admire their ingenuity; but their insertion would involve the Magazine in a controversy not very well suited to its pages.

Errata in our last Number.—Col. 1, p. 474, line 23, for "Had matter and motion ever a beginning? If not," read "Had matter and motion never a beginning? or, if they had."

Col. 2, line 11 from the top, for "far, far," read "so far."

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and generally every Branch of Patent Business promptly transacted.

A complete list of Patents from the earliest period (15 Car. II. 1675.) to the present time may be examined. Fee 2s. 6d.; Clients, gratis.

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Peterborough-court, Fleet-street.

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MR. PRITCHARD'S MICROSCOPIC INVENTIONS.

Fig. 2.

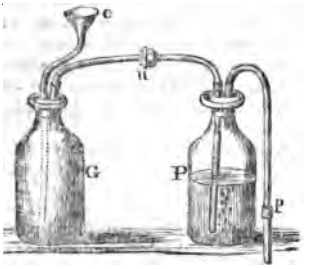


Fig. 1.

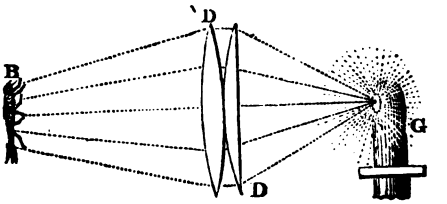


Fig. 4.

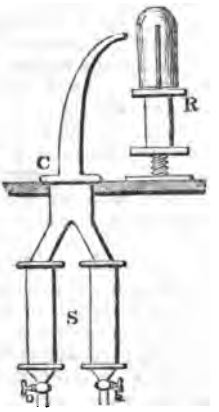


Fig. 3.

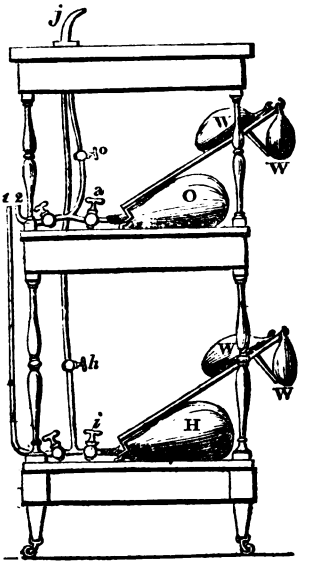


Fig. 6.

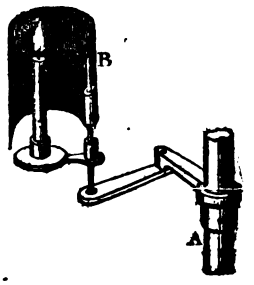
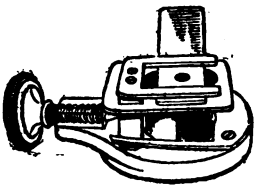


Fig. 5.



MR. PRITCHARD'S MICROSCOPIC INVENTIONS.

Mr. Pritchard, whose valuable labours in the field of microscopic science we have on various occasions noticed in our Magazine, has lately favoured the world with the further results of his researches in a work entitled "Micrographia,"* which will be found extremely useful to all engaged in this interesting branch of study. To those who already possess Mr. Pritchard's "Microscopic Illustrations" and "Microscopic Cabinet," this will supply all the practical information microscopists can require which is not afforded by those works.

Among the numerous exhibitions of the present day, few have been witnessed with more pleasure, or have conveyed more profitable amusement, than those of the Oxy-hydrogen Gas Microscope—and we have in the "Micrographia," for the first time, an ample description of the instrument, and of the method of managing it, together with figures of the various apparatus for obtaining and holding the gases. From this part of the work we make the following extracts:—

"*Illumination for Gas Microscopes.*

"It has been assumed (which, however, is not strictly true, although sufficiently so for practical uses), that the rays of light emitted from the sun are parallel to each other, and that it belongs therefore to the illuminating portion of the solar microscope merely to divert them from their parallel course, and make them converge toward the object intended to be illuminated. In the case now under consideration, the rays emanating from an artificial light placed at a short distance from the condenser are divergent, and all except the central ones fall obliquely upon the surface of the lens; hence a double operation must be performed upon them before they can be made, as in the former instance, to converge upon the object interposed for illumination; that is to say, it is necessary first to bring them parallel, and then, as in the instance of the solar, to converge them toward the object they are intended to illuminate. This, however, may be effected, as we shall presently see, with a single reflector also. In both cases the main object to be attained is to collect the greatest possible number of rays that can be taken up; to accomplish which with a lens, the surface next the light should be concave, or at least a plano, otherwise the rays nearest its margin will, owing to their great obliquity, be reflected from and not refracted through it. From the numerous experiments I have made in constructing gas-microscopes, I find the best arrangement for the illuminating part, when lenses are employed, to be similar to that shown in fig. 1 (see front page), where a plano-convex lens D is first placed with its flat surface next the light G, and at such a distance from it as to bring the divergent rays nearly parallel; and then, *in close* connexion with it, a double convex lens 'D, to condense them upon the object B. In some instances I have used three plano-convex lenses, but I do not think the advantage obtained by thus dividing the refractions at the surfaces compensates for the loss sustained by the introduction of an extra lens.† The contrivance given at fig. 1 answers so completely, that it leaves little room for any improvement to be effected by a combination of lenses, an angle of light of between 50 and 60 degrees being taken up."

In front of the object B is then placed the different magnifiers for projecting its magnified image upon a screen placed at a distance from it, for the details of which we must refer the reader to the work itself.

The apparatus by which the light is furnished is shown at fig. 3 (front page), which "represents a side view of the apparatus. It consists of a square frame of wood, running on castors, and furnished with horizontal partitions or shelves upon which the bags or bladders, O and H, containing the gases, are to be placed; the upper shelf being usually preferred for the oxygen gas, in order that the stop-cock at *o* may be the more readily adjusted, and the lower shelf for the hydrogen. Small pipes, with stop-cocks, as shown at *o*, *a*, *i*, and *h*, are annexed to the different bladders, and made to communicate with the jet J. On the upper shelf stands a purifier, hereafter to be described, for freeing the gases of their impurities, so that, without passing through any other intermediate vessels, they may, as soon as generated, be conveyed at once into the bladders, O or H, to be used when required. W W are the weights, or sand-bags, pressing, by means of inclined boards, upon the distended blad-

* Micrographia; containing Practical Essays on Reflecting, Solar, Oxy-hydrogen Gas Microscopes, Micrometers, Eye Pieces, &c. By C. R. Goring, M. D., and A. Pritchard, Esq., M. R. I., &c. Whittaker and Co. pp. 231.

† In cases where the diameters of the condensing lenses are great, and the focus short, it might be an improvement to use fluid lenses; or even, in some cases, Sir D. Brewster's polygonal lenses might be serviceable.

ders, and thus, in conjunction with the stop-cocks, acting as regulators for the steady and proportionate supply of the gases. It is scarcely worth mentioning that, during the time the bladders are being filled, the weights and boards must be of course removed.*

"The addition of a few words more on the practical method of generating and purifying the requisite gases will, I think, be in strict conformity with the design of the present tract, and suffice to render this part of the subject tolerably intelligible to the generality of readers. It has been already noticed, that a bottle, termed a purifier, is placed, for convenience sake only, on the stand at P; and, on the other side of it, not discernable at a side view, is stowed a leaden bottle also, adapted for the purpose of generating the hydrogen gas. Fig. 2 represents these two bottles, taken from their respective situations, and now supposed to be employed in the order they are exhibited. Some water and granulated zinc are first put into the leaden generator G (about a pint of water and a pound of zinc will be sufficient), and the purifier P is about two-thirds filled with water. The bottles are then securely corked, and a communication is established between them, by tubes perforating the corks, and brought into connexion with each other by an union-joint at *u*. In like manner the tube at *p* is made to communicate successively with the pipe, 1 or 2, of the several bladders intended for use. If a small quantity of sulphuric acid (about half a wine-glassful) be now poured into the funnel at *c*, a portion of the water will be decomposed, and the hydrogen gas speedily evolved, and pass through the purifier into the bladder or bags H; when the evolution becomes languid, fresh acid may from time to time be added, until the needful supply of gas is obtained.†

"The mode of generating and purifying the oxygen gas is extremely simple, and may be very summarily explained. If an iron retort, partly filled with lump manganese, be inserted into a strong fire, as soon as the manganese attains to a red heat it will part freely with the oxygen it contains; and if a communication be made between the retort and the purifier P, by means of a long tube, the oxygen will pass over into the purifier, through 2 and *a*, into the bladders at O, in the manner before described for the hydrogen. Thus the same purifier will serve for both gases; too much care, however, cannot be taken to retain the gases quite separate from each other, and not to risk the possibility of an explosion. I would caution also against the purifier being more than two-thirds filled with water, lest any of the water should be conveyed to the bladders and destroy them. The quantity of oxygen that can be contained in the bladders suited for the apparatus I have now described, will sustain a light for one hour; that of the hydrogen for about half that time; but since the latter can be very readily procured, little, if any, delay will be thereby occasioned."

The manner in which the apparatus for the combustion of the gases is constructed is shown at fig. 4, "where *o* and *h* represent the feeding-pipes of the jet, which are to be attached to the corresponding tubes of the vessels O and H (see fig. 3), designated by the same letters. At S are situated two of Hemming's safety-tubes, containing bundles of fine copper wire, gauze, or asbestos, to cool the gases, and prevent explosion, should any accident occasion the ignited gas to return towards the vessels. When speaking of the return of the gases in the direction of the vessels, and thus forming in the tubes, or vessels themselves, an highly explosive mixture, there is one point to which I have not yet alluded, but which I conceive to be of the greatest possible importance; and it is this—viz. that the areas of the bases of the vessels H and O should bear exactly the same proportion to one another, as that in which the hydrogen and oxygen gases, in reference to volume, are required to be used for consumption. The necessity of this will be sufficiently manifest, since more than twice the quantity of hydrogen to that of oxygen is expended in producing the requisite light. Whilst the gases are being consumed, their under surfaces, in the vessels H and O, by the proposed arrangement will be continually kept at

* The method by which the pressure on the gases is obtained in the apparatus, fig. 3, has been objected to, as it varies with the inclination of the boards to which the weights are attached; to remedy this inconvenience, the gas-holders might be constructed similar to the receivers of organ bellows. See Edinburgh Encyclopædia, vol. xv. P. 676. plate 442 figs. 5 and 7.

† The apparatus, fig. 2, would be found useful for many chemical experiments, and especially for exhibiting the combustion of metals by the mixed gases.

equal altitudes; and since the water ascends to these under surfaces, and the pressure there exerted is dependent upon these altitudes, as before mentioned, the pressure in both vessels will remain uniformly the same. By admitting, therefore, twice as much hydrogen as oxygen to pass through the stop cocks of the feeding-pipes of the jet, the two gases, in their due proportion, will arrive at the mixing-chamber C, pressed forward by equal forces; nor will there be any disposition in the one to overcome the force of the other, and thus to repel the mixed gas from the chamber C, back into either of the vessels, but it will proceed steadily on to the mouth of the jet, and so much of the gases only will be admitted to mix as can be contained in the small chamber at C. R represents the rod upon which the lime, in the form either of a sphere or cylinder, is sustained—(the latter form for ordinary uses is generally preferred.) In either shape the lime, by means of clock-work, or the hand, should be made to revolve, and thus present a new surface to the ignited gas, otherwise it will be liable to burn away unequally, and to burst. The lime cylinder is sometimes placed horizontally, and the flame brought to play upon its base; but this arrangement does not afford so steady a light, and a cavity being soon produced by the combustion, a strong shadow will be thrown upon the screen."

We cannot conclude this notice of Mr. Pritchard's work without extracting descriptions of two other contrivances of his, which we consider as useful as they are novel and simple:—

"*New and Simple Method of Obtaining a Delicate Adjustment of the Foci of Microscopes.*

"In Chapter XV. of the "Microscopic Cabinet," I have described the various methods by which the adjustment of the focus of microscopes is effected; such as the rack-and-pinion, the screw, the bent lever, and the excentric,* with their various advantages and defects. I have also minutely described a plan of mine, by which a coarse and fine movement may be readily obtained. This is the primary object to be accomplished. Now although that method is unobjectionable for the microscope, where single lenses or doublets are used, yet it is not so when applied to an engiscope (that is, compound microscope), the size and weight of the body to be moved rendering it unsteady. To remedy this defect, various ingenious contrivances have been devised, retaining the rack-and-pinion movement, for coarse adjustment, and applying the finer one to the stage which carries the object. All these methods, however, where the desired effect has been obtained, have been so complex, that it is not likely they will come into general use. Under these circumstances, I was led to construct the following, which it is not probable will be surpassed in simplicity or effectiveness, and, what is of great importance, cannot be easily deranged. *Fig. 5* is a perspective view of it.

"It consists of a plate attached to the stage of the instrument: on this plate is fixed a socket for holding a fine steel screw with a conical point, which latter acting against a block carrying the object held *in* a safety slider-holder, is forced upwards by the conical end of the screw acting as an inclined plane, while a spring is so arranged as to keep it down to its bearing. The milled-head of the screw, if required, might be divided, by which means the elevation or depression would become a measured quantity.

"*Improved Mode of Supporting a Candle or Lamp for Microscopes.*

"Observers with the microscope are fully aware of the importance of the proper illumination necessary to make that instrument produce the best effect: much depends upon the direction of the illuminating source, and when once properly arranged, any accidental alteration destroys the effect, and the *whole* must be commenced afresh. From these considerations, I have been induced to attach the holder for carrying the candle or lamp to the stand of the instrument, as shown in the sketch below, by which the not unfrequent movement of the instrument, especially when more than one person is observing, will not affect the direction of the illumination, as all will move together. I am convinced those who have much employed a microscope will appreciate this trifling improvement, and approve of its introduction in this work.

"A, fig. 6, is the stem of the stand of a microscope; on this the socket slides to the required elevation, and the arms allow of the light being placed in any direction. B is a shade, to take off the direct light from the observer."

* See Treatise on Optical Instruments, p. 86, fig. 36.

ELECTRICAL THEORY OF THE UNIVERSE.—MR. MACKINTOSH'S REPLY TO KINCLAVEN AND A COUNTRY TEACHER.

Sir,—I have read with some astonishment the letter of Kinclaven, inserted in your 710th number, which he seems to

suppose is a sufficient answer to the questions put to him, relative to those two important propositions upon which the truth or falsehood of the whole Newtonian system may be said to depend. Kinclaven commenced his attack upon the electrical theory with a high hand, forgetting, or, rather, ignorant of the fact, that the theory upon which he had staked his reputation, as a philosopher and mathematician, is hollow to its very centre: that the very first proposition which this theory presents for our acceptance, rests upon nothing better than a loose assumption, that neither is, nor can be demonstrated, and of which it can only be said, that it is as absurd, as it is unphilosophical. Whether the truth may be agreeable to Kinclaven or otherwise, I must take the liberty to inform him, that unless he, or some other disciple more learned than he, can, without subterfuge or equivocation, give plain satisfactory demonstrations to the two propositions to which I have pointed, the whole Newtonian system must fall to pieces. He seems to feel this already, and, as a last resort, has taken refuge behind the shield of orthodoxy; that ancient palladium that has, in all ages, afforded a convenient hiding place to the vanquished disputant and intolerant dogmatist. But, thanks to the march of science, this stale trick will serve no longer. When the Copernican system was first announced to the world, it was at once refuted by the *unanswerable* arguments of orthodoxy; and had not its venerable author been already beyond the reach of human power, he would have been convinced of his errors by inquisitions, racks, and dungeons. But we have reason to rejoice that the reign of Inquisitors is gone, and that the Copernican system remains a lasting monument of their ignorance and intolerance. Again, when Galileo announced his discovery of the satellites of Jupiter and Saturn, he also was met by the *unanswerable* arguments of the Inquisitors, and was, by these *wise* and *good* men, *fully convinced* of his errors by being confined in a dungeon. It is true the Inquisition is gone; this great bulwark of ignorance, superstition, and tyranny, has crumbled to dust. But I grieve to say the *spirit* of the *Inquisition* is left; and I grieve still further to perceive that this spirit should be exhibited by one holding, and in some respects justly so, such high pretensions to scientific attainments, as your correspondent Kinclaven. If the *power* remained, there can be little doubt that the same unanswerable arguments would be resorted to as formerly, and the voice of reason would be crushed by the humane administrators of the "Holy Office." So much for Kinclaven's unanswerable argument; let us now see how much the argument is worth.

He says, "I referred him to his own pastor for a solution of his own proposition." Well, Kinclaven, what do you think the Pastor says in answer to this query? He says that he has carefully examined the record, and that he finds no such words as "first impulse," "centrifugal force," "centripetal force," "momentum," or "angular velocity." He has confessed his total ignorance of all such things, and you have confessed your ignorance; where shall I apply next for information?

So much for his *answer* to the first question; let us now turn to the second—That unless the angular velocity is continually sustained, it would be quickly annihilated by the action of gravity. Kinclaven says, "Here again, I am sorry to inform Mr. Mackintosh, that this second question has no great pretensions to absolute wisdom." Perhaps not, Kinclaven: let us see how much wisdom there is in the answer you have given. "The answer to the first part of the question," says Kinclaven, "is, *gravitation*;" and then he proceeds to enlighten us with the old story, which may be found in any school-book, about the "maximum and minimum attraction," the "maximum and minimum momentum, &c.," and seems to imagine, in the supreme darkness of his mind, that nothing more need be said upon the subject. "Further," he says, "suppose the gravitating force of the sun were to be destroyed, then the angular motion of the planets would immediately cease; and what would be the result, the whole race of inhabitants belonging to the solar system would be frozen to death." Now this, when put into plain language, means simply—that the earth, under the action of the momentum alone, continually endeavours to proceed in a straight line, and would, therefore, under this one *force*, as it is absurdly called, be carried off from the system into far distant space; but the sun's attraction holds it back, as with a

cord, and the earth, under the action of the *two* forces, is compelled to revolve round the centre of attraction. Now this is all very plain, and easily understood, so far as it goes. There is, indeed, a little mystification introduced when the maximum and minimum forces are drawn into the account, but this mystification may be got rid of by considering, that so far as the forces are concerned, the earth's orbit may be taken as a perfect circle; that is, whatever is lost by either force on one side of the ellipse is compensated on the opposite side. Those who feel any difficulty upon this point, will, perhaps, be enabled to perceive the case more clearly by referring to the parallel case of the level and undulating railway. A level railway, embracing the whole earth, would form an orbit for a railway carriage, but this would not represent the actual orbit, or path, of the earth round the sun. The earth's orbit, or path, would be truly represented by a line of railway, consisting of one long undulation, so that the carriage would be continually accelerated in descending towards the perigee, or lowest point of the line, and exactly, in the same ratio, retarded in ascending towards the apogee, or highest point; therefore, we perceive, that by the undulation of the earth in her orbit, nothing is either gained or lost to the velocity. Now, if to the railway carriage a sufficient velocity could be imparted and *maintained*, no rails would be required to sustain the load, so long as the required velocity was sustained, the carriage, whatever its weight might be, would be sustained above the surface of the earth; so long as the velocity remained undiminished, the carriage would revolve round the earth without touching the surface. Well, Kinclaven, you are a clever mathematician, which I readily admit, I wish I could say as much for some other parts of your philosophy—perhaps you can solve the following problem:—suppose a railway carriage has a velocity imparted to it (by whatever means), sufficient to sustain it ten yards above the surface of the earth, and let its weight be one ton (that is, the gravitating force of the earth soliciting it towards the surface is one ton): now if the impelling force be wholly withdrawn, and the carriage left to move by the *force of momentum only*, would the same initial velocity be maintained, and would it continue to float round the earth for ever at a distance of ten yards from the surface, notwithstanding that it is constantly solicited towards the surface with a force equal to one ton. This is a very plain case, which *I hope* you will be able to understand.

I am afraid you do not very clearly perceive he spirit of the objection contained in my second proposition; if you did, you never could have supposed that it could be removed by the verbiage about "maximum and minimum momentum," &c. contained in your last letter. To prevent all unnecessary cavil, of which there has been too much already, you shall have a *perfect vacuum* (which is granting more than you can prove with respect to the planets), and every other condition you may choose (except a constant impelling force); that is, the moving body must be actuated by gravity and momentum only—the original force, by which the momentum was created, being wholly withdrawn.

Kinclaven has given up the "first impulse;" he has reluctantly confessed that it is far beyond his "ken," but having got himself somewhat bewildered with the "maximum and minimum momentum," he still flourishes boldly about the "rigid demonstrations." Well, we must endeavour to remove the mystification and draw him into closer quarters, and then we shall find that the grand system of first impulses, of gravity and momentum, rests upon—nothing.

In your last Number there is a very silly letter signed "A Country Teacher," in which he (said "Country Teacher") furiously attacks Mr. Thorne's geological observations, without offering *one geological* argument in support of his opinions, for which I suspect there is a very sufficient reason—he is not possessed of any geological knowledge whereon to found an argument: if he were, he could not have treated the subject in the superficial manner exhibited in his letter. Before he attempts to instruct others in geology, I would advise him to procure a little knowledge for himself; knowledge, I can assure him, is a very useful acquisition, especially for "A Country Teacher."

The Country Teacher says, "It appears that Mr. Mackintosh has one staunch supporter in the person of Mr. Thorne"—I beg to inform him that Mr. Thorne

does not stand alone in his support of the electrical theory; I have received letters from several learned societies and scientific institutions—the Geological Society of London amongst others—I have received personal and written acknowledgments from several parties distinguished for their astronomical attainments, and members of the Royal Astronomical Society, that the objections which I have brought against the Newtonian Theory are unanswerable. The electrical theory has received the commendations of several eminent Professors, amongst whom is Professor Faraday. I have the satisfaction to know that the general views there advanced have been adopted by more than one Professor in the University of Cambridge; so it will be seen, Mr. Thorne does not stand alone as a supporter of the electrical theory; neither does he nor they support it, nor is it proper that they should, unless they feel an assurance that it is founded in truth. He whose mind is stored with geological facts, can hardly withhold his assent to the conclusions advanced in that theory; whilst he, on the other hand, who is deficient in geological knowledge, can hardly be convinced by any mode of argument. It is vain to expect that any individual can form a correct opinion or conclusion upon any given subject, whilst he is deficient in the necessary knowledge upon which that opinion is to be based, or from which that conclusion is to be deduced.

I remain, Sir, yours, &c.

T. S. MACKINTOSH.

BADDELEY'S STATIONARY FIRE-ENGINE.

Sir,—I am much obliged to P. R. for his commendatory remarks upon my stationary fire-engine; at the same time, must beg to state that the application of that machine to the protection of towns or other populous places from fire, was no part of my plan. On the contrary, I most positively deny the fitness of stationary engines for any such purpose. If P. R. will refer to my letter in No. 710, he will see that the apparatus was designed *for the yards of public buildings or large manufactories.* For such places as the Bank of England, the British Museum, the large cotton and other mills in Yorkshire, Lancashire, &c. A stationary fire-engine of the kind I have submitted, has peculiar advantages, and is calculated to afford very great protection against fire.

There are a few stationary fire-engines in various parts of the metropolis, and the extreme rarity of their employment exhibits in the clearest possible manner the very circumscribed nature of their utility.

I had proposed another application of this form of engine, which I did not notice in my former communication; viz., as a floating-engine for the river, docks, &c. Mounted on a suitable boat, it would make one of the most convenient, as well as the most elegant machines, ever constructed for this purpose. It was submitted to the London Fire-establishment when their new floating-engine was under consideration, but was not considered suitable for the purpose they contemplated, viz. the employment of a varying quantity of power, according to the exigency of the case—with a preference for the vibratory to the rotary-motion.

I remain, Sir,

Yours respectfully,

WM. BADDELEY.

March 28, 1837.

COLONEL MACERONI'S ANIMATION OF HORSE-HAIRS.

Sir,—In Number 710, Captain Ogle animadverts on my idea of vitalizing horse-hairs, or other substances, by a proper application of the galvanic influence. In reply to his remarks, I take the liberty of requesting that he would do me the honour of perusing *with attention*, the four papers of mine that have already appeared in the *Mechanics' Magazine*, on the theory he appears to deprecate, and which, with your permission, I shall further develope in occasional communications. The theory, which Captain Ogle says, I have "inconsiderately promulgated," is, *that the galvanic actions, or those of light or solar emanations—of electricity, magnetism—those we call chemicals; and crystallizations—together with the phenomena of vegetable and animal life, are all one and the same—identical in action (the electromotive) as they, and all things are in origin and in substance (the solar).* I plead guilty to having promulgated such ideas, and for

the last twenty years, but not "inconsiderately," as Captain Ogle has it.

I will venture further to trespass on his leisure, by praying him to read my paper, "On Submarine Lightning and the Phosphorescence of the Sea,' in Nos. 400 and 401 of the *Mechanics' Magazine*.

I am glad that you have spared me the *meta*physico-theological part of Captain Ogle's observations, because verily (as you say) they are "unsuitable" to admixture in philosophical disquisitions. Even the Banko-Buckland-Sillimanic class of philosophers are beginning to feel that they cannot get on without making this allowance.

I am, Sir, &c.,
F. MACERONI.

March 20, 1837.

IMPROVED CHEMICAL STILL.

Fig. 1.

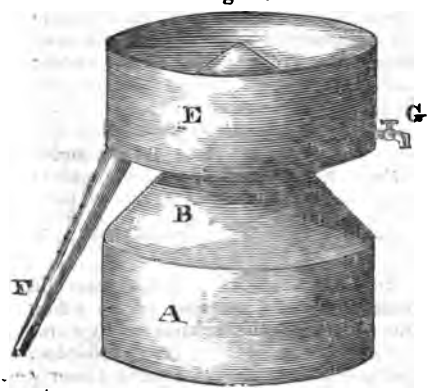


Fig. 2.

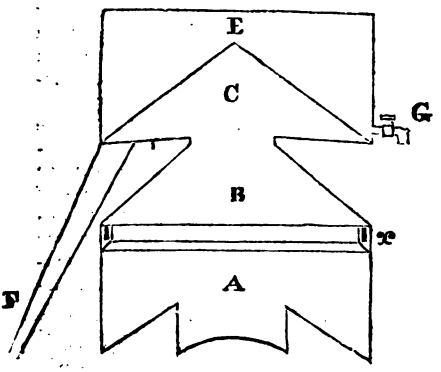
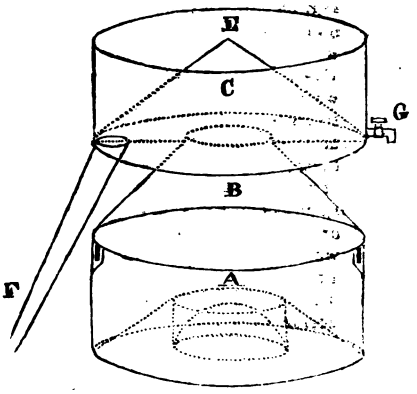


Fig. 3.



Sir,—The frequency of breaking glass-retorts, induced me to turn my attention to the construction of one of more durable materials for distillations on a small scale, over the ordinary gas-lamp. In the accompanying figures, A is the body of the still, the whole of which is made of tin, except the bottom, which is of copper tinned inside. The bottom is deeply indented, as is seen in the section (fig. 2), for the purpose of exposing a large surface to he action of the heat. The head B fits into a double rim *x*, on the body of the still, which acts as a water-valve, and effectually prevents the escape of the steam. The inner part of the rim should not be quite so high as the outer, as the condensed liquid, trickling down the inside of the head and filling the rim, has a tendency, by finding its own level, to overflow on the outer side; by drilling a few holes in the inner rim, I effectually remedied this oversight. The steam passes into the cone C, where it is condensed by the cold water in the cistern E, and the product collected within the cone, is conveyed by the pipe F (to which a leader or glass tube can be luted) into any suitable receptacle. The stop-cock G is merely for drawing off the heated water from the cistern, when it is requisite to replace it with cold; any plan of passing a current of cold water through the cistern, would, of course, be an improvement. The body of the still is made shallow to allow the rapid escape of the steam. Mine holds three quarts; and by means of it, I drew over half a gallon of compound spirit of juniper in about two hours. The heat from the gas is quite sufficient to distil the same quan-

tity of water in the course of an evening, and by this means a small drug establishment may be supplied, at little expense, with distilled water, cinnamon water, &c. There is, also, a very important saving to which it may be applied; the dregs of tinctures, even after being pressed, contain a considerable quantity of spirit; these, if put into the still with a portion of water, may be distilled as long as any spirit comes over. I suspend the still over the lamp, from the ceiling, by chains which fix upon three hooks, soldered upon the body; and it is thus out of the way, and free from the danger of being accidentally overturned.

Yours truly,

HENRY WATSON.

Chichester, Feb. 28th, 1837.

P. S.—A correspondent, in a recent Number of the Magazine (No. 701), inquires as to the quantity of moisture evolved from the flame of the gas-lamp. For instance, when my still, filled with cold liquid, is first suspended over the flame, its bottom is quickly bedewed with moisture, which collects into drops until the increasing heat of the still prevents the continuance of the deposition. The cause is obviously the hydrogen of the flame, uniting with the oxygen of the atmosphere during combustion, and the water is the result of their union.

SIR GEORGE HEAD'S HOME-TOUR IN THE MANUFACTURING DISTRICTS.

We owe the production of the volume before us, apparently, to the fraternal emulation of its author. When Captain Head (now Sir Francis Head, and Governor of Upper Canada,) attained to some literary distinction by the raciness of his "Rough Notes of a Journey across the Pampas," he was followed at a short interval by his brother, and brother-captain, with a budget of adventures related in a similar strain, although with a change of scene, under the title of "Forest Scenes and Incidents in the Wilds of North America;"—and now again, the literary world have scarcely recovered from the "sensation" produced by the "Bubbles from the Brunnen of Nassau" of Sir Francis, when they are called upon for more admiration of affected quaintness of style, and would-be oddity of remark, by the appearance of the "Home Tour" of Sir George; a book intended to be precisely of the same description, in every thing but the locality of the men and things described in its pages.*

This "Home Tour" is hardly what it professes to be; in the first place, it does not describe any particular tour at all, but consists of a number of detached sketches of places "here, there, and every where," jumbled together often without any thread of connexion whatever, and at the best of times with a very loose and slender one. In the second place, in spite of this hop-step-and-jump method of getting over the ground, it embraces any thing but a complete view of the "manufacturing districts" after all. Thus, Manchester is pretty nearly the only place in Lancashire which is visited by Sir George, and even in the few pages he has devoted to this metropolis of the cotton-trade, he contrives to avoid any description of its staple manufacture. Birmingham, the "toy-shop of Europe," and the adjoining parts of Staffordshire, the grand seat of our vast and interesting iron-trade, are excluded from this strangely-arranged Tour: the West Riding of Yorkshire is not,—but our author passes by the opportunity of making amends to the offended genius of hardware, afforded by the proximity of Sheffield, and actually makes his escape to the north without deigning so much as a word on its wonders! A feat like this *could* only be performed by the aid of his skimble-skamble style of "getting through his work:" your regular plodding every-day traveller would have found it impossible; but nothing is easier to the tourist who can pass from Carlisle in one chapter to Greenock in another (and that, too, in a tour in *England*), without condescending to explain to his readers how, why, when, or wherefore, he made the transition.

Nor does our author hesitate to extend his journeyings out of the manufacturing districts whenever he finds himself in the mood so to do. Thus, albeit, he avoids all but one corner of Lancashire, and takes no notice of one of the manufacturing capitals of Yorkshire, he makes

* A Home Tour in the Manufacturing Districts of England, in the Summer of 1835. By Sir George Head, author of "Forest Scenes and Incidents in the Wilds of North America." London, 1836. Murray. 8vo., page 484.

room for a lengthy description of his visit to Walton Hall, the residence of that renowned crocodile-rider, Mr. Waterton, and dwells for pages together on the delights of Buxton and Matlock. To be sure, these last are watering-places, and is he not writing in imitation of the "Bubbles from the Brunnen?" An idea of this description, in fact, appears to haunt him perpetually, sometimes so completely as to obliterate the recollection of the title of his own work. He can pass by Sheffield without notice, but every insignificant mineral spring he meets with on his way is made the subject of a chapter, and nothing at all in the shape of a watering-place is allowed to escape without contributing its full quota to this strangely-compounded delineation of the "manufacturing districts;" — besides Buxton and Matlock, we have full, true, and particular descriptions of the local peculiarities of "Southport," "New Brighton," "Scarborough," "Dinsdale Spa," "Allonby," and divers other known and unknown homely rivals to the foreign "Brunnen" of Sir Francis. Even when on his own proper ground, he often quits the legitimate subject of his lucubrations in an attempt to rival the odd sketches of character which distinguish the "Bubbles." The chief part of his chapter on "Manchester" is devoted to a would-be *funny* description of the numerous wedding-parties at its principal church; and at Hull his attention is divided between the wonders of its docks and warehouses, and the fittest mode of keeping squirrels in a cage! The worst of the matter is, that Sir George's frivolity is of a very laboured sort, and bears in every line the impress of being "put on" *ad libitum*, which happens to be the very worst feature that can belong to such a style as that he has adopted.

The Tour, or rather the account of it, commences at Liverpool, that is to say, at the canals between that place and Manchester, for with respect to Liverpool itself, we have very little information. The railway naturally attracts some notice, and from this portion we have extracted a page or two, as a fair specimen of our author's descriptive powers, when confined to their proper objects:—

"It is quite impossible to enter, within any brief compass, on the beauty and symmetry of the arrangements which prevail among the warehouses, and within these extensive premises. The scene I was allowed, as a stranger, to contemplate unnoticed and unmolested; I was permitted to walk from end to end, and observe and admire the address and dispatch with which multitudinous affairs were conducted. I particularly remarked the facility with which logs of timber, of the largest dimensions, and all descriptions of bulky and heavy materials, were slung on the carriages; the great size of the *Dobbin-wheels*, ten feet in diameter, occasionally employed; and also the extreme length of the ordinary Liverpool cart, for the conveyance of cotton bags, eighteen feet from tail-board to the point of the shaft, which latter is totally overhung by the body, with the exception only of four feet. These were the principal objects which diverted my attention. The load of these carts, drawn by a couple of horses, is about three tons. They allow, on the railway, four tons to a carriage, although not unfrequently they carry five; so that as, to convey timber, two carriages are lashed together, a full load may be estimated at ten tons.

"Among the cargoes put upon the railway with the greatest ease and dispatch, are pigs. This shows what management will effect; and, though strange, is at least true. Indeed this branch of business is so well assorted, that though, as to locality, the animals previous to departing on their journey are upon equal terms with the men and merchandise, as to actual juxta-position they might as well be five miles asunder. This desirable object is effected by means of a back entrance into a pig-yard, where all the herds that arrive, on their way to Manchester, find accommodation. From this there is a small door that leads down to a wooden platform, placed on an inclined plane, to the carriage standing on the railway, close to the mouth of the tunnel, so that the pigs enjoy this right of road unmolested, and, in point of fact, step quietly out of their drawing-room into the vehicle, each as easily as an old dowager into her chair waiting in the *vestibule*.

"On the occasion of my passing through the tunnel before alluded to, I sat in the foremost carriage of a train, by which were conveyed, among merchandize of many descriptions, a quantity of pigs and live cattle. The carriages were drawn about three hundred yards within the mouth of the tunnel, upon a level, by a single horse, which, at the foot of the inclined plane, was unhitched and sent back. Preparatory to the ascent, the foremost carriage was made fast by a messenger-line to the endless rope communicating with the stationary-engine at the east end, when, at the signal of a bell, the wire of which reaches the whole length, viz., a mile and a quarter, the engine commenced

its labours, and we trundled onwards in the dark at the rate of eight or ten miles an hour. There are, indeed, lights at rare intervals within the tunnel; but, nevertheless, by far the greater part of the distance is performed in total darkness. As we passed along, a train came rumbling downwards, by its own gravity, in an opposite direction. The effect was awfully grand at the approach of so stupendous a body rushing towards us in the dark, with a sound like that of distant artillery, while its conductor sat in front, holding in his hand a small glimmering lantern. The scene brought the regions of Pluto to the imagination, while the hogs grunted, and the calves lowed in funeral cadence, like a legion of discontented spirits." —P. 21.

Even here we have a slight touch of our author's propensity to wander after irrelevant matters: the pigs seem, as it were, continually pressing forward to take the most conspicuous place on the canvass: this is not the only passage in the book where the same thing occurs—the mysteries of pig-driving are dwelt upon with great unction, whenever an opportunity presents itself for dragging in an allusion to that fascinating subject. And why? —because Sir Francis, in his "Bubbles," made so palpable a hit in his description of the German *Schwein-General!*

The next point is "Southport"—one of the watering-places already alluded to, where we have a great deal of information on the important head of donkey-riding; from thence, taking Chester in the way, we progress to Northwich and its salt-mines, (of a descent into which a long description is given)—and thence to Manchester. Lancashire is then finished off with a visit to a pin-manufactory at Warrington, and a glass-house at St. Helen's; and we reach the West Riding of Yorkshire, through some lengthy chapters devoted to a dissertation on the comparative merits of the various caverns at Buxton and Matlock. The staple manufacture of the West Riding is, at any rate, more fortunate than that of Lancashire: Halifax, Wakefield, Huddersfield, Dewsbury, and Leeds, are successively visited, and divers processes of the woollen-manufacture, almost of necessity, described: that of the "rag-grinding" at Dewsbury, by which the foulest and rottenest of garments are, by the magic of machinery, made again as good as new, is, in particular, amusingly detailed. At Leeds our author keeps more than usually close to his tether, and, *notwithstanding* he is in the very heart of a manufacturing district, confines himself almost entirely to manufacturing subjects. Just before, however, be it remembered, he has indulged himself with the long digression on Mr. Waterton and Walton Hall.

From Leeds we are whisked off, per railway, through Selby, to the newly-risen town of Goole, which, although now of considerable importance as a seaport, is, as yet, scarcely noticed in the maps. Sir George's description of it is abundantly meagre, nor is he much improved by reaching Hull. He seems more at home in the agricultural district of Holderness, where he "wanders at his own sweet will" for no inconsiderable space. Scarborough, Whitby, and Stockton, next attract attention, and to the latter succeeds an account of Middleborough, another town in the north, which, like Goole, has attained only within a very few years to a local habitation and a name! In this part we have some interesting particulars of the bridge by which the railway crosses the Tees:—

"The mouth of the river Tees is, at the present time, an interesting point on the eastern coast; that by which the coal monopoly has been principally wrested from the Tyne and Wear; the channel whence coal-fields, which, but for the discoveries and improvements of modern times, would have remained undisturbed these fifty years to come, have been compelled to disembogue their produce for the London market.

"These local operations have chiefly been effected by the people called Quakers, to whom the town of Middleborough especially owes its birth. 'The Quakers' Railroad,' as it is termed, upon the north bank of the Tees, extends from their coal-field near Darlington as far as Stockton, where it crosses the river by a suspension bridge, and proceeds four miles farther along the southern shore straight to Middleborough. The 'Clarence Railway' reaches from the neighbourhood of Durham to a point on the north bank of the Tees, somewhat lower down the river than the former: hence the proprietors, though not with the energy of the other establishment, are now making shipments.

"The following anecdote relating to the suspension-bridge across the Tees, before mentioned, forms a part of its early history:—

"The number of coal-waggons which now pass over it, linked together, is almost indefinite; at all events, the trains cover the whole surface of the platform and ground on

both banks of the river besides. When the bridge was completed on the suspension principle, it was found, by previous experiment, not to be strong enough even for twenty waggons, the number then stipulated for. The first trial was made with sixteen, on which the bridge gave way; that is to say, as the sixteen carriages advanced upon the platform, the latter, yielding at first to their weight, became elevated in the middle, so as by degrees to form an apex, which was no sooner surmounted by half the number, than the couplings broke asunder, and eight carriages rolled one way, and eight another, —the one set onwards on their way, and the other back again. In consequence of this misadventure, the construction was necessarily altered, the platform remaining suspended, as before, but being fortified underneath by four starlings, upon which it is supported. By the latter operation the stress on the chains was so effectually relieved, that the platform now assumes a convex appearance.

"By pacing the platform, I found it to be one hundred and four yards in length: it swings on twelve chains, six on one side and six on the other; the circumference of the links of the chains is six inches and a quarter; the number of perpendicular rods, of three inches and five-eighths circumference, are one hundred and ten,—fifty-five on one side, and fifty-five on the other. As the trains of coal-waggons crossed, the whole space appeared to be covered by about five and twenty; the whole train being longer considerably than the bridge.

"A train of coal-waggons, touching close together, and motionless on a railway, occupy about ten feet of space each waggon; moving, and at the extent of their couplings, considerably more; the weight of an empty coal-waggon is from 26 to 30 cwt.—the load 53 cwt., or a Newcastle chaldron,—the weight of the engine eight tons; consequently, the weight laid on the bridge at present is more than an hundred tons."—P. 29.

From Middleborough, the Tourist proceeds still further north to Sunderland and Newcastle, taking it for granted, as he goes, that the miner and the mariner are as decidedly members of the manufacturing classes as the weaver and the blacksmith. He then crosses to the western coast, and, apropos of nothing, makes that sudden appearance at Greenock of which we have heretofore spoken. The "marriage-manufactory" at Gretna-green comes in for a visit, as do (*mirabile dictu*) the lakes of Cumberland and Westmoreland—the very antipodes of any thing in the shape of a "manufacturing district." Finally, after a notice of the harbour of Whitehaven, and the temperance society of Preston, this "strange, eventful history" concludes by leaving its author in the midst of the "fells" at Ulverstone, after crossing the shifting sands of Morcambe Bay; strange conclusion to as strange a volume. The reader who is conversant with British topography, will have observed, from this enumeration of the places visited, alone, that the Tourist, after leaving the West Riding of Yorkshire, has been travelling away from the "districts" which may be strictly called "manufacturing," and that, at the conclusion, after a long sojourn in the most pastoral district in England, he is again approaching the seat of our grandest branch of industry, and precisely that part of it, into the bargain, which is omitted in the earlier portion of the book; to wit, Lancashire, to the northward of Liverpool and Manchester. It was worthy of so eccentric an individual as our author, to seize on that very moment to close his labours, and so give an appropriate finish to a work, one half of whose pages are in direct contradiction to the promise of the title-page.

Having already given samples of Sir George's talent for description and digression, we shall wind up with a specimen of his eloquence. It occurs in the course of the account of his stay at Leeds:—

"There can be no spectacle more grateful to the heart of an Englishman, than viewing the interior of a manufactory of machinery, to observe the features of each hard-working mechanic, blackened by smoke, yet radiant with the light of intelligence,—to contrast with his humble station the lines of fervid thought that mark his countenance and direct his sinewy arm,—and to reflect that to such combination of the powers of mind and body, England owes her present state of commercial greatness. It is no less pleasing to consider, that although particular classes of men have suffered by the substitution of machinery for manual labour, such evils arise from the mutability of human affairs,—are such as the most zealous philanthropist cannot avert; and, lastly, of themselves insignificant, compared with the general demand for labour throughout the country, which has not only kept pace with the improvement of machinery, but no doubt might be shown even to have exceeded it;—nay, it might be made manifest, that not only is the grand

total of operatives employed throughout the manufacturing districts augmented, but additional employment afforded in like proportion for mechanics to supply the wear and tear of machinery, and buildings dependent thereupon, as well as for workmen upon all works to be traced to a similar cause, such as railroads, bridges, viaducts, aqueducts, &c."—P. 184.

REPLY TO THE "VOICE FROM THE SHOP-BOARD."

Sir,—From causes I need not here explain, I did not see any of the Numbers of the *Mechanics' Magazine* till Thursday last, when I was surprised to find an article headed "A Voice from the Shop-board," the object of which is to depreciate the tailors' work-table appearing in Number 694.

I leave to your correspondent the physiological discussion of the subject, as I propose nothing more than sitting on a stool in an ordinary manner, merely observing that the articulation of the shoulder joint is equally "favourable" to playing the violin upon the back of the neck.

Your correspondent says, it is not sitting cross-legged, but sitting too close together, which is the source of disease; and yet, a little while after, he urges, as an objection to the table, that it removes the workmen farther apart!

He finds fault with the sewing appendage; but how any one can say that that which can be placed in any position suited to the eye is not within its reach, or that that should be farther out of a man's controul which is not so wide (as is the case with the pressing supports, they being not so wide, when extended, as the knees, and, therefore, more within the power of the workman),* I am at a loss to know! Any ordinary mechanic would have informed your correspondent that a great number could be so arranged as to occupy considerably less room for each, than if every table were constructed singly; a frame-work of four inches between the peripheries of the inner circle, being, I believe, sufficient to support the revolving boards.

Any person placing a number of pence in the smallest space upon a level plane, will have a correct idea of the manner of arrangement for hundreds if required—allowing about one-seventh or one-eighth of each piece for the frame-work between. Amongst the strange arguments in favour of the present mode, your correspondent says, that sitting cross-legged produces straight forms, and sitting in the way I propose would be fatiguing and tiresome to the limbs. This is too bad; do surgeons recommend the posture used in the trade to cure distortions? or do painters and sculptors seek their living models among the fraternity of tailors? or does any one entering a public-house, frequented by tailors, expect to find them seated cross legged upon the tables to avoid fatigue of the limbs?

The circumstances which led to the design of the table are these:—a person, who from illness, occasioned by sitting in the posture tailors usually do, was compelled to relinquish it, but not being able to change his trade, I proposed his sitting upon a stool to a board just high enough for the thigh to pass under; upon this board was placed a common square stool, stuffed with horse-hair, and covered with carpet (previously used as a foot-stool) five inches high, and one foot square, on which was placed a bundle of pieces of cloth bound together, as piece-brokers usually bind them. Upon the bundle he has sewn, and on the stool he has pressed, for the last two years, executing his work with great neatness and dispatch, and losing nothing by the exchange, but the uneasy sensations occasioned by his previous method, and gaining much in manual force, when pressing.

The work table is but an improvement of this contrivance, substituting two moveable blocks, with cushions, for the stool, and the centre cushion, with plug and screw, in lieu of the bundle of cloth; the circular board was adopted for suiting light, a great number, and to prevent the work from hanging more than it does in the usual mode. I am prepared to prove its perfect adaptation to its intended use, and should be willing to communicate with any person for practical purposes; but I think I have sufficiently answered the objections of the "Voice from the Shop-board."

I am, Sir, yours, &c.

J. R. CROFT.

19, Moscow-road, Bayswater, March 11, 1837.

* The knees, when extended, of a 5 foot 8 man measure more than 20 inches, the cushions extend only 18 inches. The drawing, which is isometrical, represents one square yard.

MR. SIEVIER'S PATENT CAOUTCHOUC CORDAGE.

Sir,—In consequence of a letter which appeared in your valuable journal respecting Mr. Sievier's "patent rope," and the strictures thereon by your correspondent Many-points, I was induced to procure a piece of the said rope from the Company's establishment at Tottenham, prepared and manufactured according to the directions given in the specification by the patentee; it measured 4 feet 6 inches long, and was $\frac{3}{4}$ths of an inch in diameter, composed of 12 strands, each strand had a slip of India-rubber in its centre. This was placed in the garden in a northerly aspect, and allowed to remain exposed for two nights and days to a frosty atmosphere, uncovered, the thermometer being at the time at 29°. When removed early on the third morning from its Siberian situation, it was found to be pliable and elastic, and its length was the same.

A similar piece was immersed in a butt of cold water, and allowed to remain for ten days; at the expiration of the above time it was removed, and its elasticity, pliability, strength, and length, were found to be the same as when first put into the water. Caoutchouc, or India-rubber, by itself becomes very hard when exposed to the atmospheric air, or when immersed in cold water for any time; but this change does not take place when it is interlaced or combined in any way with good hempen thread—the rigidity is prevented, its elasticity is preserved, and its pliability remains. Perhaps Many-points was not aware of this fact.

Hoping the above brief statement of facts will satisfy Many-points, as well as your numerous readers,

I am, Mr. Editor,

Yours respectfully,

NAUTICUS.

March 28, 1837.

EFFECTS OF HIGHLY-HEATED METALS ON THE GENERATION OF STEAM.

Sir,—I can confirm the statement of Mr. Tomlinson, in your Number of Jan. 28th last, that water is more rapidly evaporated from the surface of metal heated to about 212° to 220° of Fahrenheit, than when it is raised to a much higher temperature.

After carefully repeating this experiment a great number of times, I believe it to be a law that always obtains, when the water is not acting under pressure;—*how far* the same rule then applies, I am not prepared to say, although this certainly appears to be the most important part of the question, and that from which most practical usefulness may be expected to result.

Your correspondent D (p. 495), cannot understand, but that the steam generated by the contact of the water with the heated metal *must* pass through the globule. I think, if he will perform the experiment (a plate of hot iron will do very well for the purpose) he will no longer be in any difficulty about the matter. He will find the steam generated under, and escaping round, the globule of water, imparting to it that rotary and jumping motion, which always takes place when the temperature of the metal is greatly raised. If the heat of the iron does not much exceed 212°, the water spreads upon and wets its surface, from which it is rapidly evaporated; but when very hot, the water is repelled from the surface as though the iron was greasy, and small globules are formed as before described. Perhaps the stratum of heated air rising from the metal has something to do with the repulsion.

I remain, Sir,

Yours respectfully,

WM. BADDELEY.

March 27, 1837.

LIST OF ENGLISH PATENTS, GRANTED BETWEEN THE 25TH OF FEBRUARY AND 27TH OF MARCH, 1837.

John Robinson, of North Shields, engineer, for a nipping lever for causing the rotation of wheels, shafts, or cylinders under certain circumstances. Feb. 28; six months to specify.

David Stevenson, of Bath-place, New-road, gentleman, for a new method of preparing writing-paper, from which writing-ink cannot be expunged or abstracted without detection; being partly a communication from a foreigner residing abroad. March 2; six months.

Thomas Bradshaw Whitfield, of New-street-square, Middlesex, lamp-manufacturer, for improvements in producing parallel motion to the piston-rods of pumps for lamps (?) and other purposes; which improvements are also applicable to machinery in general, where parallel motion is required. March 4; six months.

Samuel Stocker, of Bristol, gentleman, for improvements in pumps. March 4; six months.

Charles Francois Edward Aubin, of No. 26, Grande Rue Verte, Paris, in the Kingdom of France, gentleman, but now of Cockspur-street in

the county of Middlesex, for an improvement or improvements in preparing writing-paper, so as to prevent the discharge of the ink therefrom without detection, and to prevent the falsification of writing thereon. March 4; six months.

Henry Backhouse, of Walmsley, Bury, calico-printer, and Jeremiah Grune, of Bury, Lancaster, engraver, for certain improvements in the art of block-printing. March 7; six months.

John Shaw, of Rishworth, Halifax, book-keeper, for improved machinery in preparing wool, and also in preparing the waste of cotton-wool for spinning. March 7; six months.

John Consitt, of Manchester, merchant, for certain improvements in the machinery used for spinning, doubling, and twisting cotton and other fibrous substances. March 8; six months.

Charles William Celarier, of St. Paul's-chain, London, Esq., for certain improvements in lamps, particularly for causing the oil to ascend; which improvements or parts thereof are applicable to the raising of water and other liquids; being a communication from a foreigner residing abroad. March 10; six months.

Neil Snodgrass, of Glasgow, in the county of Lanark, engineer, for improvements in steam-engines and other mechanism of steam-boats. March 15; six months.

Henry Christopher Windle, of Walsall, Stafford, merchant, Joseph Gillott, of Birmingham, metallic pen-manufacturer, and Stephen Morris, of Birmingham, aforesaid, artisan, for improved means of giving elasticity, freedom of action, and durability to certain parts of pens or instruments used in writing, as also of obtaining a supply and flow of ink to the same. March 15; two months.

Charles Francois Edward Aulas, of No. 38, Grande Rue Verte, Paris, gentleman, but now of Cockspur-street, for a new and improved method of cutting and working wood by machinery; being a communication from a foreigner residing abroad. March 15; six months.

Richard Macnamara, of Hunter street, Southwark, gentleman, for certain improvements in paving, pitching, or covering streets, roads, and other ways; which improvements are applicable to other purposes. March 15; six months.

Henry Davies, of Stoke Prior, Worcester, engineer, for certain improved apparatus or machinery for obtaining mechanical power; also certain improved apparatus or machinery for impelling or raising fluids. March 15; six months.

William Maugham, of Newport-street, Lambeth, chemist, for improvements in the manufacture of white-lead. March 15; six months.

James Walton, of Sowerby, Bridge Mills, in Wadsley, Halifax, woollen-manufacturer and dresser, for improvements in machinery for manufacturing and finishing of woollen and some other cloths. March 21; six months.

Moses Poole, of Lincoln's-inn, gentleman, for improvements in making fermented liquors; being a communication from a foreigner residing abroad. March 21; six months.

Robert Neilson, of Liverpool, gentleman, for a machine for preparing and cleaning coffee from the pod or husk, and separating the different qualities so as to render it better adapted for the purposes of roasting and consumption. March 21; two months.

Miles Berry, of Chancery-lane, mechanical draftsman, for certain improvements in machinery for heckling or combing, and preparing and roving hemp, flax, tow, and other vegetable fibrous materials; being a communication from a foreigner residing abroad. March 27; six months.

LIST OF SCOTCH PATENTS, GRANTED BETWEEN THE 22ND OF FEBRUARY AND 22ND OF MARCH, 1837, INCLUSIVE.

James Cook, of Birmingham, gun-manufacturer, for improvements in gas-burners. Sealed Feb. 22, 1837.

Francois de Tansch, of Percy-street, Bedford-square, military engineer to the King of Bavaria, for improvements in apparatus or machinery for propelling of vessels, for raising water, and for various other purposes. Feb. 24.

John Isaac Hawkins, of Chase Cottage, Hampstead-road, civil engineer, in consequence of a communication made to him by a certain foreigner residing abroad, for certain improvements in the application of the products of combustion in generating and in aiding of steam for giving motion to steam-engines. March 4.

William Wright, of Salford, Lancaster, machine-maker, for certain improvements in twisting machinery, used in the preparation of spinning or twisting of cotton, flax, silk, wool, hemp, and other fibrous substances. March 6.

Peter Ascanius Tealdi, formerly of Mondoir, in Piedmont, but now residing in Manchester, merchant, in consequence of a communication made to him by a certain foreigner residing abroad, for an invention of a new extract, or vegetable acid obtained from substances not hitherto used for that purpose, which may be employed in various processes of manufacture, and in culinary or other useful purposes, together with the process of obtaining the same. March 6.

John Burns Smith, of Salford, spinner, and John Smith, of Halifax, dyer, for a certain method or methods of tentering, stretching, or keeping out cloth to its width (made either of cotton, silk, wool, or any other fibrous substances,) by machinery. March 6.

Edmund Shaw, of Fenchurch-street, London, Mariner, in consequence of a communication made to him by by a certain foreigner residing abroad, for an invention of an improvement in the manufacture of paper. March 8.

John Shaw, of Rishworth, Halifax, book-keeper, for improved machinery in preparing wool, and also in preparing the waste of cotton-wool for spinning. March 9.

George Bertie Paterson, of Peacock-street, Newington, Surrey, engineer, for certain improvements in the construction of meters or apparatus for measuring gas or liquids. March 14.

Thomas Theophilus Biggs, of Queen Ann-street, Cavendish-square, Middlesex, Esq., in consequence of a communication made to him by a certain foreigner, and invention by himself, of improvements in certain descriptions of fire arms. March 17.

John Lebrecht Steinhaeuer, of Upper-terrace, Islington, merchant, in consequence of a communication made to him by a certain foreigner residing abroad, for an invention of improvements in hand and power-looms. March 17.

Fletcher Woolley, of York-street East, Commercial-road, Middlesex, gentleman, for improvements in the manufacture or preparation of materials to be used as a substitute for bees'-wax; parts of which improvements are applicable to other purposes. March 17.

Neil Snodgrass, of Glasgow, engineer, for improvements in steam-engines and other mechanism of steam-boats; which were partly communicated by a foreigner residing abroad, and partly invented by himself. March 21.

Miles Berry, of Chancery-lane, Middlesex, mechanical draftsman, in consequence of a communication from a foreigner residing abroad, for certain improvements in cleaning, purifying, and drying wheat and other grain or seeds. March 22.

NOTES AND NOTICES.

Italian Railroad.—In all probability the first instance of the construction of a public railway at individual expense, will be afforded by that which is about to be made from Milan to Monza, in Lombardy. The proprietor, who appears from his name to be of German origin, expects to be able to run the distance in about a quarter of an hour, although, by the present road, it occupies the swiftest horses at least an hour.

School of Mines.—Mr. John Taylor, well known as a lecturer on Mineralogy, and great promoter of the search for subterranean riches, is at present actively engaged in endeavouring to found a national "School of Mines," for giving instruction in all that relates to the theory as well as the practice, of mining operations. Such institutions have long been in existence in Germany, where they have proved of great utility.

Fruits of Parliamentary Interference.—In the course of the evidence given before the Parliamentary Committee on Public Walks, a year or two ago, it was strongly recommended that Bonner's-fields, near Bethnal-green, should be converted into a sort of park for the benefit of the inhabitants of the vicinity, who have no opportunity, being some five or six miles distant, of participating with the good folks of the West end in the advantages of any of the already-existing parks. At that time, the spot was open to all comers, and, being of considerable extent, covered with green-sward, and dotted here and there with trees, formed no bad substitute for the thing desiderated. Very recently, however, the green-sward has been enclosed with a high railing, the pleasantest of the foot-paths stopped up, and the public restricted to a gravelled way of some yard-and-a-half wide, with a fence on either hand. Thus it happens, that the silent march of encroachment is ever too active for the spirit of improvement: more damage was done, probably, by the penny wise measure of building upon Moorfields—a large open space just where it was most required, on the very borders of the most densely-populated part of the city—than can be repaired, at any expense, by the most extensive and most costly "improvements" of the present day.

Watch-making at Geneva.—This manufacture commenced in 1587, and in 1601 the town council first legislated upon it. In 1685 there were counted 100 masters and 300 journeymen watch makers at Geneva, who turned out of hand 5,000 watches yearly. There were also 80 masters, and 200 journeymen jewellers. The trade continued increasing till 1789, when it was at its height. In that year the number of those engaged in it, in the city alone, was 4,000, and 2,000 in the suburbs and villages. There are not now so many hands engaged, though more watches are made; the diminution of manual labour being occasioned by improved tools and machinery, and abridged mechanism of the watch. But in consequence of the very low price of the work, workmen earn considerably less than they used to do. The wages are now actually a third less than they were fifty years ago. There has been a great falling off in this manufacture, but very lately it has rather revived again.

Spring Locomotive.—The New Jersey folks are going it like a hurricane on the railroad principle. No horse power—no steam—no canvass—nothing short of *real perpetual loco foco motion.* Hear what the *Monmouth Enquirer* saith to the point:—"As to the locomotive, it is unlike any thing ever constructed, and a description can therefore give but a faint idea of it; but we will try to explain it a little. There are upwards of 500 springs about an inch and a half wide, as thick as a shilling, and eleven feet long, made of steel, the same as the mainspring of a watch; these are wound around a number of spindles placed perpendicular in two trunks which hang one on each side of the rail, the spindles terminate at the cog wheels, all of which, each side, work into each other, and into a set of wheel-works, which work into and turn the wheel that sets astride of the rail, and this puts the whole machine in motion. There is also for guiding and balancing, a small wheel before and another behind the main wheel. It must be evident that these 500 springs (and the number may be increased) possess an immense power, which, if brought to bear on a single point, or wheel, will send a locomotive with the velocity of a tornado."—*True Sun.*

We understand a French gentleman, named Rousseau, has lately secured a patent in this country for his invention intended for the improvement of Champaigne. This discovery will solve one of the most important problems in the art of brewing, namely, that of rendering ales, cyder &c., sparkling and perfectly clear to the last drop immediately after it is bottled, without the use of any drug or chemical process.—*Ib.*

Will "A Mechanic" again favour us with his address?

☞ British and Foreign Patents taken out with economy and despatch; Specifications, Disclaimers, and Amendments, prepared or revised; Caveats entered; and, generally every Branch of Patent Business promptly transacted.

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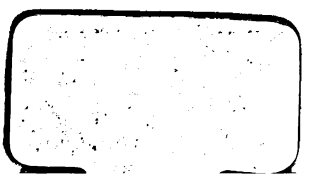
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